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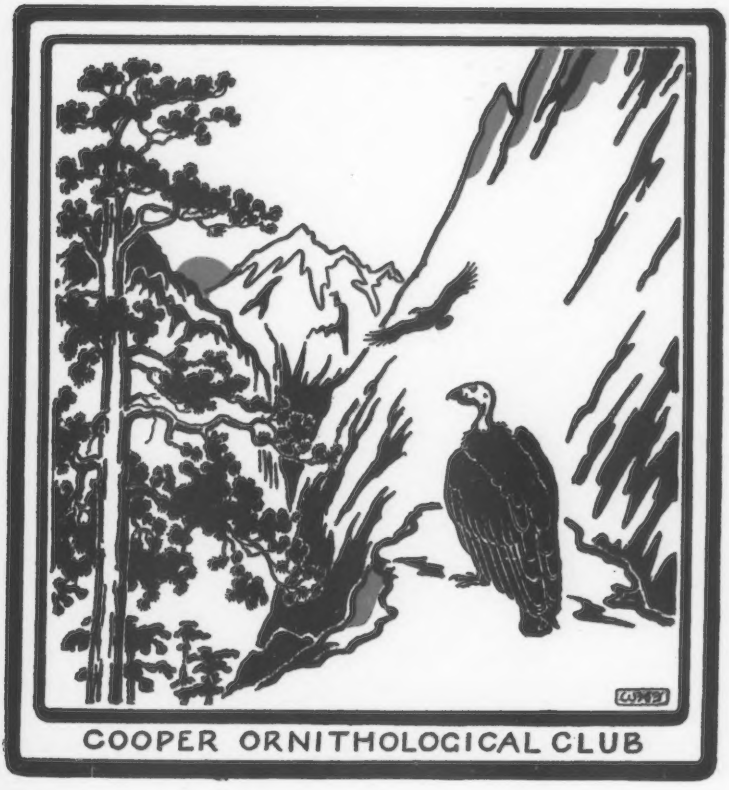
THE CONDOR

A Magazine of Western Ornithology

Volume XLI September-October, 1939 Number 5



COOPER ORNITHOLOGICAL CLUB

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A Magazine of Western Ornithology

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THE CONDOR

VOLUME XLI SEPTEMBER-OCTOBER, 1939 NUMBER 5

A REVIEW OF THE HOUSE FINCHES OF THE SUBGENUS BURRICA

WITH THREE ILLUSTRATIONS

By ROBERT T. MOORE

It has been assumed generally by zoologists that the genus *Carpodacus* originated somewhere on the mainland of Asia. As long ago as 1898 Bianchi recognized twenty-five species of this genus, six belonging to the Nearctic and nineteen to the Palaearctic Region, while all but one (*C. erythrinus*) were claimed to be inhabitants of alpine districts. Because of differentiation into so many more full species in Asiatic countries than in North America, authors have believed the genus existed in Asia for a longer period of time. Not conceding that this is sufficient evidence, the author, after a long study of approximately fifteen hundred specimens, covering all the North American species and races, has nevertheless come to the conclusion that the present distribution can be explained best on the basis of an Asiatic origin. If this is true, it seems necessary to grant further that the ancestral forms came from the north in preglacial times and that the acquisition of new territory probably took place from north to south at fairly high elevations. The Mexican plateau may have been occupied during this period and the occupation of the deserts to the west, the islands off the coast of the Californias, the lowlands on both sides of Mexico and the Sierra del Sur of southern Mexico may have been forced by depressed temperatures during the glacial periods. Finally, we may assume that the characters of the populations which stayed and adjusted themselves to the climatic conditions at these lower levels have had a longer time to be moulded by the new meteorological forces that they encountered than the populations which may have shuttled up and down the Mexican plateau in periodic efforts to reoccupy their older habitats. This may account for the greater differentiation between the southern races of house finches (subgenus *Burrica*) than between those of the cooler regions to the north, which regions may not have been reoccupied for a very long period of time. Even today a gradual occupation of new territory in the northern United States and southern Canada is in progress.

Much of the above belongs to the field of speculation. This paper is concerned with the study of factual data for the purpose of determining the present distribution of this elusive subgenus and its trends in differentiation, and it will touch upon the foregoing theories only in so far as they may be of help in understanding the distribution.

In spite of the enormous number of specimens I have directly compared, it is impossible satisfactorily to determine the breeding ranges of certain races. There still are large areas, many of them in the United States, as in eastern Utah, from which few specimens seem to be available. To supply these satisfactorily at least another five hundred individuals would be required. Therefore, no claim to have attained finality in these studies is made. They merely break the ground for future research workers to cultivate more efficiently. I have noted on the distribution maps (figs. 35, 36), with black dots or circles, every locality from which specimens have been examined, the circles indicating intergrading areas. The absence of dots from large portions of the

maps proves how much collecting must be done to obtain a complete picture. It should be recognized, however, that there are certain very definite gaps in the range of *Burrica*, notably one in southern Sinaloa, and others in northwestern Oregon and western Washington, which are not occupied. That the latter may be occupied in the future is possibly indicated by the appearance of a group of breeding birds on the southeastern end of Vancouver Island. The House Finches are definitely "on the march!" It has been only in the past few years that they have begun to occupy two portions of Canada, and only a few decades ago they do not seem to have been in the Denver region of Colorado (Figgins, 1930, pp. 1-2). The recent occupation of certain islands of the Hawaiian group is probably due to man, but there are some reasons to believe that the presence of *Carpodacus mexicanus mexicanus* on the southeastern end of the Mexican plateau may be due to a geologically recent annexation of a former habitat.

The affinities of the forms of *Burrica* and the crescendo or decrescendo of their characters from one race to another seem to lie along north-south axes, except for the races of the peculiar Sierra del Sur of Mexico. It is true that considerable evidence exists of east-west or west-east developments in other regions, but the developments which have operated along longitudinal lines seem to have been more powerful than those along latitudinal lines, or at least the characters, as they appear to progress from one race to an adjoining race, increase or decrease along north-south axes to maximum or minimum expression, while the evidences of alterations along east-west axes are blurred. However complex these fluctuations may have been in the past, two of the characters of *Burrica* have been sufficiently susceptible to meteorological pressures to become definitely moulded when populations have pushed into new areas, and a third character has been strongly directed so that when it has started on a course toward maximum or minimum expression it has generally continued on to a greater extreme, even when it has entered an adjoining area of slightly different meteorological pressures. The first two are ground color of posterior underparts, hereafter to be called merely "ground color," and streaking, while the third is size. A fourth character, "red" coloration, is as likely to develop to maximum expansion over the body in one extreme type of climate as it is in another of just the opposite extreme; but these alterations progress along a north-south axis, except in the Sierra del Sur.

There seem to be three kinds of characters: (a) susceptible ones definitely correlated with climatic areas, such as streaking and ground color; (b) moderately susceptible ones, definitely directed toward certain extreme expressions, which may not reach their maxima or minima within the climatic area which directed them (size belongs here and so may coloration of the rumps of females); (c) those which seem to have little or no relation to climatic areas, such as extent of red coloration and the sharply defined red U on the pileum in males.

Taking into account the less important as well as the important characters, we find the subgenus *Burrica* divided today into four main groups, which for the discussion of trends, may be called, (1) the desert, (2) the coastal, (3) the plateau, and (4) the Sierra del Sur, hereafter to be called the "sur group" (see fig. 37). The first three have approximately north-south axes, the fourth an east-west one. When discussing these groups I shall have occasion frequently to refer to rainfall areas. Whenever I use the term "five inch rainfall area" it will mean the area, in which the mean annual rainfall ranges from zero to five inches, whereas the term "ten inch rainfall area" will cover a range from five to ten inches, and so on.

The desert group occupies the great longitudinal arid belt of the continent, west of the Rocky Mountains and the Sierra Madre of Mexico, where the mean annual

rainfall is generally less than ten inches. But, it extends into fifteen inch rainfall areas, sometimes in modified form, notably in the hot coastal plains of northern Sinaloa. This group includes three races, *Carpodacus mexicanus solitudinis* of southeastern Oregon and Nevada, and *C. m. ruberrimus* and *C. m. rhodopnus* of Mexico. As a group these races occupy the continuous stretch of five and ten inch rainfall areas from eastern Oregon and southwestern Idaho south through Nevada, western Utah, southeastern California, western Arizona, and the arid coastal plains of Sonora, to the northern half of Sinaloa and to the interrupted coastal plains and most of the southern half of eastern Lower California. The group also seems to occupy the ten inch rainfall area along the Yakima Valley of southern Washington. The birds reported (no specimens collected) from the Okanogan Valley of northeastern Washington and southern British Columbia probably belong with this group, just as do those from the ten inch rainfall area of the San Joaquin Valley of central California, which, although they are intergrades with *C. m. grinnelli* of northwestern California, seem closer to the white-bellied northern section of the desert group. Reference to the distribution maps (figs. 35, 36) will show that the desert group separates the plateau group on the east from the coastal group on the west.

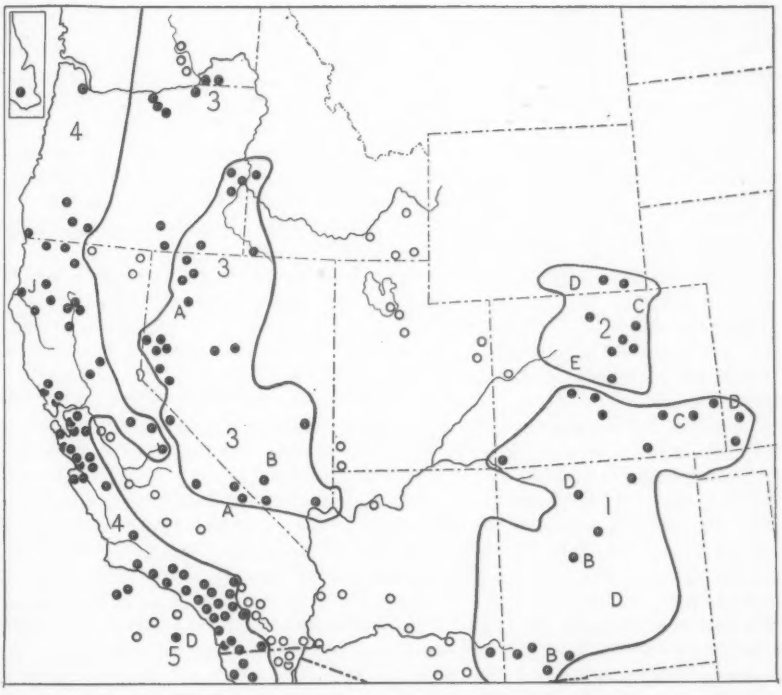

Fig. 35. Distribution of House Finches. Each dot marks a locality from which specimens have been examined; circles indicate intergrades. 1=*C. m. frontalis*; 2=*C. m. smithi*; 3=*C. m. solitudinis*; 4=*C. m. grinnelli*; 5=*C. m. clementis*. A, annual rainfall 0-5 inches; B, 5-10; C, 10-15; D, 15-20; E, 20-30; J, over 80. Black lines enclose areas where characters of races are best developed.

The characters of the desert group, which differentiate it from all the other groups consist of: (1) narrowest and least conspicuous streaking of under parts throughout the entire range of the group; (2) whitest ground color; (3) smallest size, and (4) most intense coloration of yellow or red on rump of females; (5) most extensive red coloration. It is significant that all four of the important characters and one of the less important reach either a maximum or a minimum for the subgenus in this group.

It should be noted that some ten inch rainfall areas occur in the Rocky Mountain states, and a very considerable one in eastern Utah. Few specimens are available from this last region. So susceptible are ground color and streaking, that specimens from small scattered ten inch rainfall areas in Colorado and New Mexico show these two characters to be modified in the direction of the desert group, whereas other less susceptible characters, such as extensiveness of red and size, remain the same as in the typical race of the region. From this I think it reasonable to conclude, particularly when it is shown later that ground color is much darker in heavier rainfall areas, that ground color and streaking in the subgenus *Burrica* are definitely correlated with climatic areas.

The coastal group is found on the Pacific coast and in certain areas farther inland, west of the southern Cascades and the Sierra Nevadas, in rainfall areas of fifteen inches or more or where the average number of days of dense fog amounts to over thirty days a year, as on certain islands of the Pacific. The characters are best expressed in rainfall areas of thirty inches or more. The group is the only one in the United States which has a race in the sixty to eighty inch rainfall area, and this race attains its extreme expression of characters there. The occurrences at Forrest Grove, Washington, and Victoria, B. C., may mean that this race is extending its range in this heavy rainfall area. This group includes *C. m. grinnelli* of southwestern Oregon and northwestern California, as well as a race (*clementis*) and three species (*mcgregori, amplus,* and *mutans*) on islands of the Pacific Ocean. The group ranges from southwestern Oregon south throughout California, except in the five and ten inch rainfall areas, and occurs in the San Pedro Mártir Mountains of Lower California; also on the Santa Barbara Islands, Los Coronados, San Benito, Cedros, Guadalupe and Hawaiian islands. Near Point Concepcion the group forks, the western division crossing to the Santa Barbara Islands and developing certain characters of the group from island to island in a more or less regular progression to Guadalupe Island. The mainland fork proceeds south on the mainland, west of the San Joaquin Valley, to the San Pedro Mártir Mountains, keeping in rainfall areas of ten inches or more, becoming somewhat paler in ground color and less conspicuous in streaking. The insular series of races becomes darker and more conspicuously streaked, and larger in size of bill.

There is no single character, which distinguishes this assemblage as a group from the other three, but the bill attains the maximum in size in *amplus* of Guadalupe Island, and the progression of red coloration is markedly different from that in both the desert and the plateau groups. The red extends posteriorly to the center of the breast in southwestern Oregon, maintains this extension as far as the San Francisco Bay region and then decreases on the islands, reaching almost the minimum for the subgenus in *amplus* (see fig. 37). In the mainland fork it changes little. Exactly the opposite progression occurs in both the desert and plateau groups.

Two other possible distinguishing characters are ones which are not generally considered characters, first, the presence of orange and yellow feathers in males, and second, the essential absence of the female costume in first winter plumage for males, hereafter for conciseness only to be called the "eclipse plumage." In using "eclipse

plumage" it is realized that this term has been confined to use in the Anatidae and connotes there something quite different. The orange and yellow types are much more common in the coastal group (18.4 per cent of the total specimens as compared with 3.3 per cent for the desert and plateau groups and 7.8 per cent for the Sierra del Sur group). The eclipse plumage occurs in 1.2 per cent of the coastal group as compared with 7.4 per cent in the desert and plateau groups. I am familiar with the conclusions reached by Mr. and Mrs. Michener (1931), whose indefatigability and research spirit cannot be praised too highly. Their banded birds were individuals of the coastal group and add to the evidence for the occurrence of a considerable percentage of orange and yellow plumage in this group. It should be pointed out that the Micheners do not claim that all first year males of the mainland show yellow or orange in the plumage, nor even that a majority do so. Island conditions seem to develop this tendency to the maximum, so that 73 per cent of males from San Clemente and 100 per cent of those from the Hawaiian Islands show some abnormal coloration.

The progression of the four important characters in the coastal group differs remarkably from that in the desert group, much *more so* than it does from either of the other two groups (see fig. 37). In fact, the trends in the coastal group, particularly the insular fork, are actually closer to those of the sur group of extreme southern Mexico than to any other. The characters in the mainland fork, as would be anticipated, generally approach those of birds of the intergrading areas of the southern Colorado Desert, but the trends from north to south are very different from those of this desert group.

The forms of the plateau group range from southern Wyoming south along the Rocky Mountains through New Mexico and western Texas, and thence east of the Sierra Madre of Mexico. They spread out fan-shape over the entire Mexican plateau as far as Tamaulipas, southern San Luis Potosi, Guanajuato, Michoacan and Jalisco, and probably to the Rio Balsas. Here the group suddenly ends near the boundaries of the sur group. A fork of this group extends its range into extreme eastern Arizona. In the United States and northern Mexico, the group is found in the ten to twenty inch rainfall regions, chiefly above fifteen inches, whereas in central Mexico *Carpodacus mexicanus centralis* is found in the twenty to thirty inch area of Guanajuato, and two races occur in the forty to sixty inch area along the higher parts of the Sierra Madre range of Sinaloa and south to lower elevations in Nayarit and Jalisco.

This group contains *smithi, frontalis, nigrescens, potosinus, centralis, coccineus* and the mountain birds of Sinaloa.

Only one character distinguishes this group from all the other three, but three characters differ decidedly from those in the desert group and one, extent of red, from those of the sur group. Size reaches its maximum for *Burrica* in *centralis* of this group; in fact the birds of all races in the group are large. In addition, the number of young males in eclipse plumage attains its maximum percentage for the subgenus in the northern range of the group, 26.8 for *smithi* and *frontalis*, as compared with 9.9 for *C. mexicanus mexicanus* and the birds of Guerrero and 12.4 for *solitudinis*.

The sur group is a peculiar one without definite trends, which occupies twenty to sixty inch rainfall areas and extends chiefly along the great west-east mountain range that lies south of the Mexican plateau and is separated from it by two tropical river systems, the Rio Balsas and Rio Tonto, as well as by the great volcanic province, which crosses the whole southern end of the Mexican plateau from west to east. This group also extends across these barriers up on to the southeastern portion of the Mexican plateau through Mexico and Morelos to Hidalgo and through Puebla into the sixty inch rainfall area of Veracruz.

That this group is very distinct from the other three seems clearly indicated, for the development of critical characters from north to south in the desert and plateau groups, which reaches a climax in Sinaloa and Guanajuato, respectively, is not con-

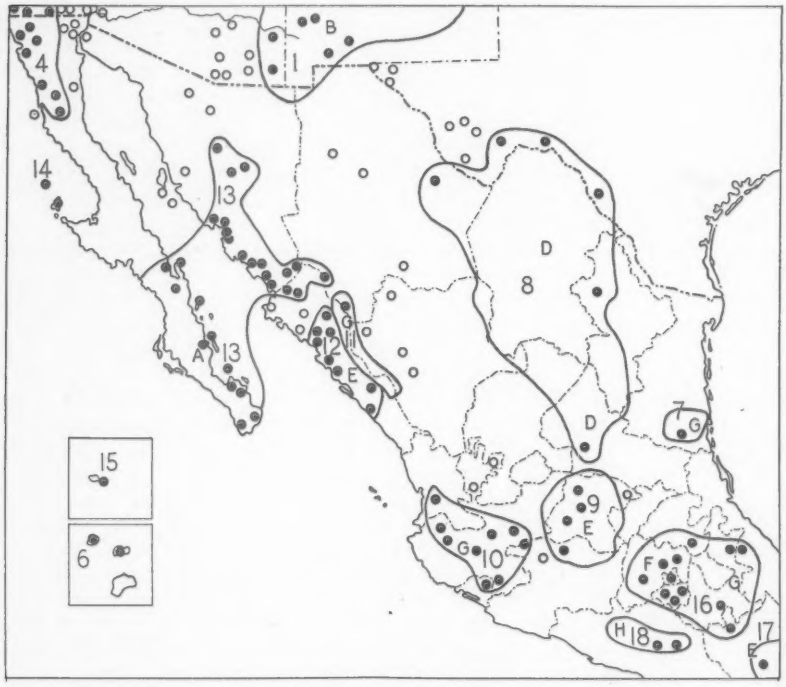

Fig. 36. Distribution of House Finches (symbols as in fig. 35): 1=*C. m. frontalis*; 4=*C. m. grinnelli*; 6=*C. mutans*; 7=*C. m. nigrescens*; 8=*C. m. potosinus*; 9=*C. m. centralis*; 10=*C. m. coccineus*; 11=*C. m. altitudinis*; 12=*C. m. rhodopnus*; 13=*C. m. ruberrimus*; 14=*C. mcgregori*; 15=*C. amplus*; 16=*C. m. mexicanus*; 17=*C. m. roseipectus*; 18=*C. m. griscomi*. A, annual rainfall 0-5 inches; B, 5-10; C, 10-15; D, 15-20; E, 20-30; F, 30-40; G, 40-60; H, 60-80.

tinued on into the sur group. A sudden and complete change occurs. For example, the extent of red in the desert group reaches its maximum and suddenly ends at the unoccupied area in southern Sinaloa, whereas in the plateau group, the progression stops with the extensively red *centralis* of Guanajuato. Then, only a hundred and fifty miles to the southeast we find the least extensively red race of the entire subgenus, *C. m. mexicanus* of the Sierra del Sur. So far no positive intergrades between the sur group and the others have been found. To a less degree a similar change is noted in size. This decreases to the smallest race in Sinaloa, but south of the "gap" a very large race suddenly appears. Contrariwise, to the east, size increases from Colorado to the largest race, *centralis* of Guanajuato, and then diminishes sharply in *C. m. mexicanus* of Hidalgo, declining to a moderate-sized bird in Guerrero.

These and other peculiarities, lure one to speculate that the house finch populations were driven off the Plateau by the decreasing temperatures of the ice ages, and held in Oaxaca and Guerrero, isolated from the main stream of *Burrica* for a long period of time and that their inclination to return during the warmer periods of the ice ages was checked by some unknown cause. It does no harm to point out that geologists (Schuchert, 1935, pp. 55, 41, 130) claim that unparalleled volcanic outbursts flamed along the volcanic province during the Pleistocene. Possibly *C. m. mexicanus* has too recently crept back on to the plateau to intergrade with the plateau group, which may have re-established itself from the east or west and developed its present characters at a much earlier date.

Two of the characters of the sur group, most highly developed in the birds of Guerrero, are remarkably different from those of all the other groups and are approached only by races geographically far distant. The first is the sharply defined red U on the forehead of males, the uprights of the U continuing as superciliary streaks on each side of the crown. In all other races of *Burrica,* even when the crown is not definitely incarnidined, the red of the superciliary areas merges gradually into the crown. The second character is the minimum extent of red, the color being reduced to a sharply defined throat patch and to the U of the forehead. A third character reaches its maximum in this group: ground color increases to Cinnamon Buff and Clay Color. (Names of colors in this paper, when capitalized, are taken from Ridgway, 1912.)

The sur group includes three forms, *C. mexicanus mexicanus, C. m. roseipectus,* and the undescribed bird of Guerrero.

If we refer to the chart of increase and decrease of characters (fig. 37), we will find the four characters, which we consider the most important in *Burrica,* represented graphically to show how different is the progression of characters in adjoining groups. The coastal, desert and plateau groups run lengthwise of the page to indicate their north-south axes, whereas the sur group is shown horizontally to indicate an east-west axis south of the others. The same character in each group is represented by the same kind of column. The varying widths of the columns show the average relation of that character to maximum or minimum expression, a width of 8 mm. indicating in every case the maximum expression reached in the subgenus, and a point, the minimum. An attempt has been made to place the name of a state as nearly as possible immediately opposite the point of correct widths of the columns. Only males at about the same stage of wear in the nuptial plumage were used for this chart.

As an illustration, the average wing length of the largest race is 82.1 mm. for *centralis* of Guanajuato at the southern end of the plateau group. The wing length for the smallest race, *rhodopnus* of Sinaloa, at the southern end of the desert group is 71.2 mm., a difference of nearly 11.0 mm. The average wing length of the most northern race of the plateau group, *smithi,* is 78.1 mm., or exactly 4 mm. less than the average wing length of the largest race. Four millimeters is 36.1 per cent of the difference between the wing length of the longest and the shortest race. Accordingly we make the width at the top of the column for size of the plateau group 6.9 mm. Now turning to the races at the southern end of each group, we find that *amplus* of Guadalupe Island in the coastal group has a greater wing length than the race at the top of the column of the same group by 24.5 per cent of the above-mentioned range of 11.0 mm., and we therefore increase the width of the column at the bottom opposite this race by that percentage of 8 mm. On the contrary, wing length in the desert group grows smaller as we proceed south and reaches the extreme minimum for *Burrica*; so, the size column of this group reduces to a point. Employing the same method for the

size column of the plateau group, we find size increasing toward the south to *centralis* of Guanajuato, where the extreme maximum for *Burrica* is attained; the width of this column at the bottom is shown as 8 mm.

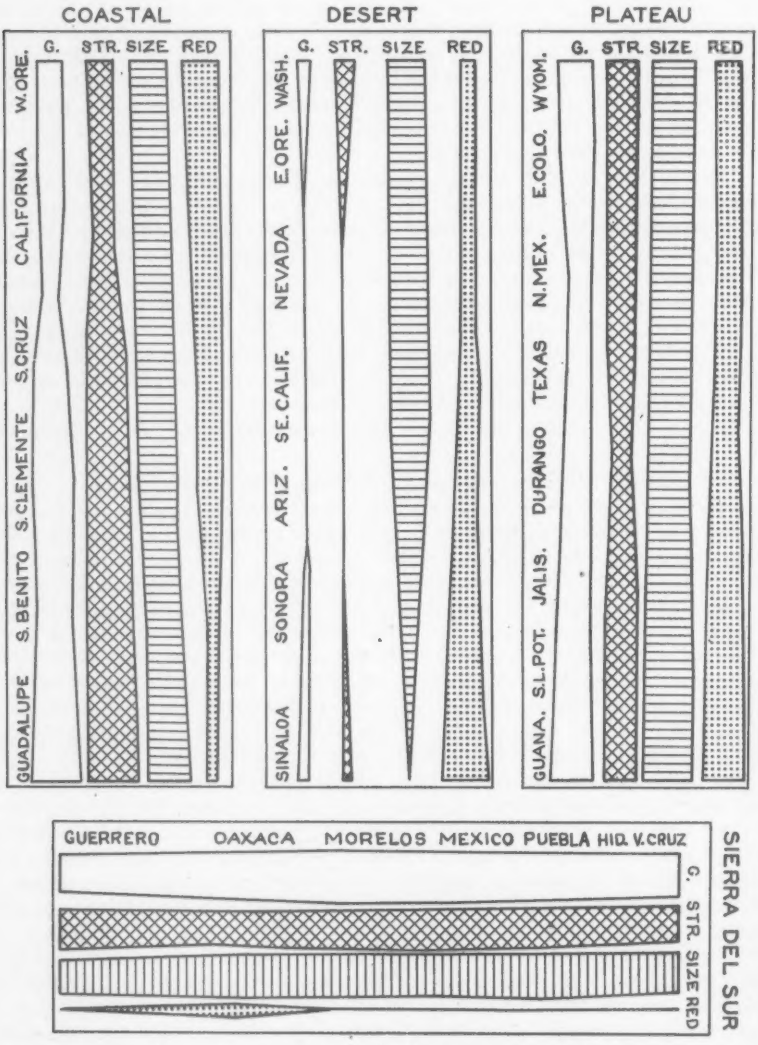
COASTAL
DESERT
PLATEAU
G. STR. SIZE RED
GUADALUPE S.BENITO S.CLEMENTE S.CRUZ CALIFORNIA W.ORE.
SINALOA SONORA ARIZ. SE.CALIF. NEVADA E.ORE. WASH.
GUANA. S.L.POT. JALIS. DURANGO TEXAS N.MEX. E.COLO. WYOM.
GUERRERO OAXACA MORELOS MEXICO PUEBLA HID. V.CRUZ
G. STR. SIZE RED
SIERRA DEL SUR

Fig. 37. Chart showing increase and decrease of characters in races and species of House Finches. G.=ground color of posterior under parts; Str.=streaking; size=wing length; Red=degree of extension of "red" coloration on under surface. Widths of columns indicate relative intensity of characters. For further explanation see text, p. 183.

A quick glance at the three upright columns for size reveals instantly that whereas size, as represented by wing length alone, increases to, or nearly to, maximum in both the coastal and plateau groups as we proceed south, it does just the opposite in the group geographically between them, the desert group.

It may be of some significance that of the twenty-four maxima and minima occurring in the columns of the three vertical groups, most of them are found in terminal races of the groups. This would seem to indicate that a progressive movement, once initiated in any character, proceeds on to either a maximum or minimum until the terminal race of the group is reached, where it, like the group, stops. This seems particularly clear in the desert group, where the two southern branches, forking to extend on either side of the Gulf of California, reach clearly defined and unquestionable terminal races in *ruberrimus,* which ceases at the southern tip of the peninsula, and in *rhodopnus* which stops just as abruptly in central Sinaloa, where the gap in the range of the entire species is reached near the Tropic of Cancer. With *rhodopnus* the extreme minimum for size and the extreme maximum for extent of red of the entire subgenus are reached. Furthermore, a fourth maximum in a character, not represented by a column, is attained, that is, brightest coloration on rump of females.

Four maxima and minima which do not occur in terminal races are ground color and streaking in the desert and plateau groups. It is just in these two characters that we would expect exceptions, for these seem to be the only two that are definitely correlated with climatic areas. Therefore, they should reach their minima where the climatic factors (mean annual rainfall, mean annual maximum temperature and daytime cloudiness) reach their minimum extremes. These extremes for the North American continent are attained in the desert region, near the head of the Gulf of California (Brooks, 1936), and it is exactly there that we find the minima reached by the two characters mentioned.

I should preclude here a possible misinterpretation of a statement which appears in an earlier paper on house finches (Moore, 1936, p. 205). Although the streaking of *rhodopnus* is less than in *ruberrimus,* I find by lifting up each feather of the lower abdomen that the more extensive red has so completely covered up the streaks that it has eclipsed them. So completely blurred is the streaking that it is difficult to get an exact comparison. I am now convinced that *rhodopnus* and *ruberrimus* of Sonora, which both inhabit a heavier rainfall area than the region at the head of the Gulf, are not less streaked than in the intergrades of the latter region, and probably are slightly more streaked.

In the plateau group the minima for meteorological factors occur from New Mexico to Durango, and it is in this section at the middle of the columns, that we find ground color and streaking reaching the minima for this group. The picture of what happens in the sur group is very incomplete because of the lack of specimens from Oaxaca. Not having seen recently the only specimens in existence of *roseipectus,* those in the British Museum, I am unable to show the widths of the columns accurately, so it is futile to discuss the changes from one race to another in this group.

It admittedly is impossible to obtain exact percentages for widths of columns in the chart to represent ground color, streaking and extent of red. Nevertheless, approximate accuracy can be reached, sufficient to show the changes that occur. A great amount of time was taken in making these as accurate as possible. The enormous series assembled made it possible to select for comparison a sufficient number of males of the same stage of wear in almost every form. In only two of the eighteen forms were insufficient numbers obtained, but even in these, quite a few were found which gave

some idea of the comparative relation. As an example, let us take the most difficult character to measure mathematically, ground color of the posterior under parts. The portion of the body chosen for determination of color value was a horizontal band across the center of the abdomen, including the sides. This area on each specimen was compared carefully with the tables in Ridgway's color standards and the exact color value taken. When the value for the sides differed from that of the abdomen, the values were averaged. Then the values for all the males were averaged and were found to deviate but slightly, although the differences between sides and center of abdomen were subject to some variation. Dependent on the increment of gray on Ridgway's color plates and the relative depth of tone, all the color values were given consecutive numbers in a scale, so that only a small amount of possible error is involved in the averaging process. The color values matched the following plates of Ridgway, only one value being added, namely "Ivory White". This value represents a very small increment of yellow which occurs in certain forms of the coastal group and in birds of the southwest portion of the Mexican plateau. The values are surprisingly numerous and are given here in the reverse order, starting with plate LIII of Ridgway: White, Ivory White, Pallid Mouse Gray, Pale Mouse Gray, Mouse Gray, Pale Smoke Gray, Drab Gray, Pale Drab Gray, Light Drab, Drab, Pale Olive Buff, Tilleul Buff, Vinaceous-Buff, Pale Vinaceous Fawn, Cartridge Buff, Ivory Yellow, Pale Pinkish Buff, Pinkish Buff, Cinnamon Buff, Clay Color, Pale Pinkish Cinnamon, Light Pinkish Cinnamon, Pinkish Cinnamon, Cinnamon, Pale Cinnamon Pink, Light Vinaceous Cinnamon. Classifying these values in order of depth of tone and letting "White" be represented by a point in each open column and Clay Color by 8 mm. of width, a sufficiently accurate picture is obtained to give a very fair idea of the changes which occur in ground color.

The author has found it extremely important in this subgenus to compare only birds of the same amount of wear. This is due to the fact that all of the forms acquire their nuptial plumage by the gradual wearing off of the fine margins of the winter plumage. It has been repeatedly pointed out, particularly by the Micheners (1931), that the bright coloration of male house finches changes from month to month and even from year to year in some individuals, creating a series of traps for an unsuspecting systematist. Every conceivable effort has been made to discount specimens of unusual coloration. For most practical purposes it has been found sufficient to group the birds as follows: (1) September-October, early winter plumages, (2) January-February, late winter plumages, (3) late April-May and early June, worn nuptial plumages, (4) July-August, very worn nuptial plumages before molt.

Although the author would have preferred to publish lists of localities of all the specimens examined in connection with this study, this would have lengthened the paper excessively and would have repeated data already presented in descriptions of recently named races. Every locality is shown on the distribution maps (figs. 35, 36).

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Subgenus **Burrica** Ridgway

Burrica Ridgway, Man. N. Amer. Birds, 1887, p. 390. Type, by original designation, *Fringilla mexicana* Müller.

Subgeneric characters.—As compared with the subgenus *Carpodacus*, *Burrica* differs in having tail much less emarginate; wing relatively shorter, the difference between wing and tail slightly less than length of tarsus in southern races; adult males with wing feathers margined with pale grayish, rather than pinkish; streaks on upper parts of both sexes less conspicuous, except in *Carpodacus mexicanus centralis* of Guanajuato. Normally, young males molt directly from the juvenal plumage into that of the adult male, exactly contrary to the procedure in the subgenus *Carpodacus*, but about four per cent, chiefly in the plateau and desert groups, maintain the female plumage throughout the first year.

Ridgway's key (1901, p. 124) makes a differentiation under division "aa," which is no longer admissible; he states that the "tail" is "shorter than wing by much *less* (italics mine) than length of tarsus." These studies prove that in northern races of *Carpodacus mexicanus*, the difference between the tail and wing is considerably *more* than the length of the tarsus, but that in the group ranging from Hidalgo to Guerrero, and in the races of the arid coastal plains of southern Sonora, Sinaloa and southern Lower California, Ridgway's statement holds true, the difference being equal to, or slightly less, than the length of the tarsus.

Carpodacus mexicanus

Specific characters.—Differs from *C. amplus* and *C. mcgregori* in having bill considerably smaller; bill shorter, and shallower at its deepest point. Differs from *mutans* in coloration of brightly colored parts.

Ridgway (1901, pp. 141-142) gave measurements for *mcgregori* and *amplus*, indicating that they possessed longer wings and tails than any race of *mexicanus*. He did not have a long series from Guanajuato, and he grouped those he had under the too inclusive name, *rhodocolpus*. Measurements of our much larger series of thirty-three fresh specimens from Guanajuato show that *centralis* has the longest wing and tail of all the forms of house finches, whereas *amplus* and *mcgregori* possess the largest bills (see table of measurements). Accordingly, we are reduced to a single character, that of size of bill, in differentiating the species *C. mexicanus* from these two island birds. Nevertheless, in view of the appearance on Cedros Island of sharply differentiated individuals of both *mcgregori* and *mexicanus*, which live together in the same habitat, and, taking into consideration the isolation of *amplus* on Guadalupe Island, it is not wise at present to reduce *amplus* and *mcgregori* to races of *mexicanus*.

The problem of *C. mutans* of the Hawaiian Islands is still more perplexing. This form almost certainly arose following the introduction of some race of *mexicanus*. It was described (Grinnell, 1912, pp. 24-25) on the basis of one character, the yellow-orange type of coloration in males. There are, however, other discernible differences, and another character may be developing. All of the six adult males in the collection of the Museum of Vertebrate Zoology have the tenth (outer) primary the longest, except for the left wing of one male. Contrasted with this, all except three out of 476 specimens of *mexicanus, amplus* and *mcgregori,* which I have examined for this character show either the ninth or eighth primary the longest, and the tenth rarely equal to the others. A reference to the table on p. 203 will show that the measurements of *mutans* are close to those of the central California bird. With reference to the relation of length of tarsus to the difference between length of wing and tail, the Hawaiian individuals are also closest to central California birds. Obviously a large series is needed to determine the status of this form.

The relationship of the birds ranging from Hidalgo to Guerrero, now known as *C. mexicanus mexicanus,* with the races to the west and north, which are separated by only a few miles of zoologically unexplored mainland in eastern Michoacan, Queretaro and northern Guerrero, is the most puzzling of all. When Sharpe (1888, p. 421) described *"Carpodacus frontalis,"* he considered it to be specifically distinct from *C. mexicanus;* he said, *"C. mexicanus* perhaps merges into *C. frontalis;* but I have seen no sign of this in the series of specimens examined." In the large series which has been assembled by me no specimen has come under observation which would indicate intergradation. An individual from Temascaltepec in worn nuptial plumage, unlike a typical *C. m. mexicanus* from the same place, has vestiges of Carmine on its breast, indicating that it might have been more extensively red in winter plumage. Otherwise, it is a typical *mexicanus,* with the sharply defined U outlining the pileum and with brown back with no reddish tinge. In spite of this slight "approach," it is vastly different from three nearly typical *C. m. centralis* males from Lago de Ciutzeo, only one hundred miles to the northwest which have entirely reddish brown upper parts and the red extending below to the abdomen. No two races of the entire species are so widely separated in characters and so closely juxtaposed geographically as these two. In one hundred miles there is a far greater change than in the two thousand miles from Canada to Guanajuato. This is not the way the species behaves in other parts of its range. For example, the birds of Lower California and those of Sonora, though entirely out of contact and separated by the Gulf of California, are in my judgement identical. In spite of the relatively great difference between *C. m. mexicanus* and *C. m. centralis,* our lack of specimens from Queretaro, and eastern and southern Michoacan makes it unwise to upset the present concept of conspecific relationship.

Carpodacus mexicanus frontalis Say

Pueblo House Finch

Fringilla frontalis Say, *in* Long, Exped. Rocky Mountains, vol. II, 1823, p. 40 (note). Arkansas River, near the mountains=near Pueblo, Colorado; type lost.

Carpodacus obscurus McCall, Proc. Acad. Nat. Sci. Phila., vol. V, 1851, p. 220. Santa Fe, New Mexico; type in Acad. Nat. Sci. Phila.; female, or male without red.

[*Carpodacus mexicanus*] *sayi* Figgins, Proc. Colorado Mus. Nat. Hist., vol. IX, no. 1, April 22, 1930, p. 3. No type selected.

Subspecific characters.—A medium sized bird with wing averaging about 20 mm. longer than the tail, the average difference exceeding that of the tarsus by less than 2 mm.; eighth or ninth primary generally longest; in winter plumage (description is taken from a recently molted September bird in winter plumage from Rocky Ford, Otero County, Colorado, on the Arkansas River, fifty miles east

of the type locality; no specimen from Pueblo seems to be available), ground color of upper parts of adult male Light Drab to Hair Brown, blotched or spotted, but never conspicuously streaked with Deep Brownish Vinaceous even on forehead and crown; rump brighter, each feather margined with gray; vinaceous color of forehead and superciliary region not sharply defined; chin, throat and jugulum Light Russet-Vinaceous to Russet-Vinaceous, the color extending to middle of breast; ground color of posterior under parts Tilleul-Buff to Pinkish Buff on sides, marked by medium wide streaks approximating Hair Brown. In adult males in worn nuptial plumage vinaceous worn away on upper parts, completely on the back as a rule, but rump, forehead and a marginal line on each side of crown becomes brightened by wear to Carmine; vinaceous of under parts worn away almost completely from breast, and brightened by wear to Carmine or Nopal Red; ground color of posterior under parts brightened by wear to a color varying from Pallid Mouse Gray to Tilleul-Buff, sometimes to Pale Pinkish Cinnamon. Adult females in winter plumage Light Drab to Drab above, obscurely blotched with darker, the rump seldom colored with bright yellow or red, generally faintly buffy, not nearly so much so as in juveniles; ground color of under parts varying from Drab Gray to Pallid Mouse Gray, but in worn nuptial plumage to Tilleul-Buff or Ivory Yellow; in winter plumage streaks on under parts medium wide, becoming narrower and sharper in nuptial plumage.

Range.—Upper and Lower Austral zones from western Kansas, northwestern corner of Cimarron County, Oklahoma, Colorado south of Arkansas River, and western Colorado west of the Divide, south through New Mexico to eastern Arizona, and to western Texas.

Specimens examined.—The localities of all specimens are shown either by circles or black dots on the distribution maps (figs. 35, 36). This method of representation will be used for each form in this paper. The names of the localities will be kept permanently with the manuscript for the use of future revisers. Colorado, 23 ♂ ♂, 11 ♀ ♀; Kansas, 4 ♂ ♂, 5 ♀ ♀; New Mexico, 15 ♂ ♂, 3 ♀ ♀ (includes types of *C. obscurus* McCall and *C. familiaris* McCall); Arizona, 2 ♂ ♂. Intergrades with *potosinus*: Texas, El Paso and Brewster counties, 17 ♂ ♂. Intergrade with *coccineus*: Chihuahua, Carmen, 1 ♂. Migrant *frontalis*: Chihuahua, 2 ♂ ♂. Intergrades with *ruberrimus*: Arizona, 39 ♂ ♂, 25 ♀ ♀, 2 jv.; Sonora, 15 ♂ ♂, 1 ♀. Migrant intergrades: Sonora, 6 ♂ ♂, 2(?).

The type specimen, now lost, came from the "Arkansas River near the mountains," which the A. O. U. Check-list gives as "near Pueblo, Colorado." Among the specimens examined, some (Coal Creek, Cañon City) were taken about twenty-eight miles to the west of Pueblo, one (Rocky Ford) fifty miles to the east and others about the same distance to the south. It seems fairly certain, although I have not been able to obtain specimens from Pueblo, that, if the house finch occurs there, it is the same as the above-mentioned birds, which in worn nuptial plumage have more extensive and brighter red on the under parts, paler ground color on the posterior under parts and narrower streaking than *smithi* from Arapahoe County, Colorado.

As foreseen by Figgins (1930) *Fringilla frontalis* Say is a composite. One of its components, the bird of northeast Colorado, he described as *C. m. smithi* (p. 3). He then proposed *sayi* as a substitute for *frontalis* Say. Stone (1930, p. 590) correctly stated that this proposal was based on a misunderstanding of an earlier statement by Oberholser (1899, p. 186), and reduced *sayi* to the synonomy of *frontalis*. However, Figgins was correct in the matter of recognizing *Fringilla frontalis* Say as a composite of more than two races. As a matter of fact, it was a composite of four races: (1) *C. m. smithi* mentioned above, (2) the bird of Colorado, south of the Arkansas River and west of the Divide, Kansas, Oklahoma, New Mexico and extreme eastern Arizona, to which the name *Fringilla frontalis* Say properly applies, (3) the paler *solitudinis* of the Great Basin, and (4) the darker, more extensively red, *grinnelli* on the west coast.

When Figgins proposed *sayi*, he did not mention a type. It is true Figgins had in mind two specimens, one from Montezuma County and one from Grandby, Grand County, Colorado. Neither of these two has "type" marked on the labels and Mr. Alfred M. Bailey writes me that he cannot find a specimen so marked in the collection of the Colorado Museum of Natural History. This name represents a composite of two races, since the bird from Grandby, although slightly intermediate in character, is in my

judgment closer to *smithi*. To avoid possible confusion, I restrict the application of this name *sayi* to the bird of "Montezuma County," Colorado, and designate this county as the type locality. No nomenclatural significance can be attached to *Carpodacus californicus* Coues (1865, p. 164), since it merely misidentifies *"Carpodacus frontalis"* for *Carpodacus purpureus californicus*, and is not coupled with any pertinent information.

Individuals in winter plumage from Hamilton and Morton counties, Kansas, are difficult to determine in the absence of birds in nuptial plumage, but I place them with *frontalis*. I have not seen specimens from Cimarron County, Oklahoma (Tate, 1925, p. 176), but presume they belong to this race. The male from Four Corners, Montezuma County, mentioned above, has sharper streaking and brighter coloration and in my judgement is definitely *frontalis*. An adult male taken in June from Grand Junction is the same.

Most of the specimens from northern Sonora south to Kino Bay seem to be intergrades between *frontalis* and *ruberrimus*. Eight of these intergrades have been taken as migrants in southern Sonora.

Four years ago the author noted a number of non-juvenal specimens of this race in female plumage that were marked males. As the large series began to amass, an increasing number was detected, until curiosity impelled him to list every case with collector's name, locality, plumage, date and collateral information. The total number now is fifty. None of these shows any trace of the buffiness on the rump or elsewhere that is characteristic of the juvenal plumage. About half of them were taken in the fall and winter months between October 1 and March 15. Eighteen specimens come from the range of *frontalis*, Colorado to Arizona, whereas there are eight from Nevada and seven from Lower California (*ruberrimus*). Out of an enormous number of specimens from California, only one male has female plumage, and only three have been taken from the entire coastal group out of approximately 350 specimens. These fifty specimens have been sexed by twenty-three different collectors, several of them very careful field men, who realized the problem involved. Analysis indicates a certain amount of segregation, largely in the northern portions of the plateau and desert groups. Sixty-four per cent of the aberrant individuals come from this region, ranging from Colorado to Arizona, Nevada and southeastern Oregon, in which regions only thirty-three per cent of our total number of specimens were collected. Van Rossem (1936. pp. 52-53) called attention to a similar occurrence among the birds of southeastern Nevada, but seemed to assume that this aberrant molting behavior might be confined to that region. This deviation from the normal molting procedure of the subgenus *Burrica* is normal in the purple finches of the subgenus *Carpodacus*, and indicates that what has seemed a vital difference between the subgenera is bridged over by these individuals. Furthermore, it may be recalled that the ratio of difference in wing and tail length to tarsal length which generally is characteristic of *Burrica* proves not to hold true for the *northern* races. It is tempting, but at present unwise, to jump to the conclusion, that these data give a clue to the orginal source of the subgenus *Burrica*. Nevertheless, it does etch a question mark on the dark clouds of the past, which may point to a subject worthy of further research.

Carpodacus mexicanus smithi Figgins
Dusky House Finch

Carpodacus mexicanus smithi Figgins, Proc. Colo. Mus. Nat. Hist., vol. IX, no. 1, April 22, 1930, p. 3. Near Aurora, Arapahoe County, Colorado; type in Colo. Mus. Nat. Hist.

Subspecific characters.—Darkest of the races of *Carpodacus mexicanus* in the United States; nearest to *Carpodacus mexicanus frontalis*, but differs in having ground color of posterior under parts

darker, Pale Mouse Gray to Mouse Gray, instead of Pallid Mouse Gray to Pale Pinkish Buff; streaking of under parts wider; red coloration averaging darker, at least in worn nuptial plumage.

Range.—East slope of Continental Divide in Colorado, north of Arkansas River Valley; extends north into southern Wyoming.

Specimens examined.—Wyoming, 1 ♂, 2 ♀, 1 jv.; Colorado, 64 ♂ ♂, 28 ♀ ♀. Migrants: southern Colorado, 1 ♂; Texas, El Paso County, 5 ♂ ♂.

Thanks to the courtesy of Mr. J. D. Figgins and Mr. Alfred M. Bailey, I was given the opportunity of holding a large series of *smithi* in my possession for a long period of time, while I was endeavoring to assemble specimens of *frontalis*. This has made it possible, after various interruptions, to reconsider the question of the validity of the race. As indicated under the discussion of *frontalis*, I am now convinced that *smithi* should be recognized. A number of specimens have been submitted to me by other persons, including Mr. Edward R. Warren of Colorado Springs and Mr. John W. Scott of the University of Wyoming, specimens which are obviously not soiled by coal dust and have not been "washed," and these substantiate the major characters given by the describer. It is known that house finches of the valleys of southern California wander high into the mountains after the breeding season. A similar movement may account for the appearance farther north of an occasional specimen of *frontalis* at higher altitudes. On the other hand, migrants of *smithi* appear in the range of *frontalis* and should be eliminated in comparisons by using only breeding birds. It is important in this connection that certain breeding birds of *C. m. potosinus* of San Luis Potosi, Mexico, are just as dark gray as the unsoiled gray individuals of *smithi* from Arapahoe County, Colorado. The rainfall of the habitat of *smithi* averages about ten inches more than that of *solitudinis*.

Mr. McCreary of the University of Wyoming informs me that house finches have occurred in southern Wyoming at Evanston, Kemmerer, Green River, Parco, Laramie, Cheyenne, Terrington, Ft. Laramie, Lusk, Wheatland, Midwest, Thermopolis and Big Horn Basin. He adds, "It is partially migratory, as some years it is not seen—in the winter. In the winter of 1937-38 large numbers stayed all winter." The Wyoming specimens fortunately are not soiled by soot and are referable to this race.

Carpodacus mexicanus solitudinis Moore
Desert House Finch

Carpodacus mexicanus solitudinis Moore, Proc. Biol. Soc. Wash., vol. 52, p. 107, June 24, 1939. Fallon, Nevada; type in coll. Robert T. Moore.

Subspecific characters.—A larger, much less extensively red bird than *ruberrimus*, with ground color slightly whiter (generally pure white); it is also a less extensively red bird than *frontalis* or *smithi*, with much less red above and much whiter ground color.

Range.—*Solitudinis* is most strongly differentiated in the extreme arid desert regions of Nevada where the mean annual rainfall is less than five inches, but the race extends into sections where the rainfall is from five to ten inches in Nevada, the extreme arid portions of Mono and northern Inyo counties, California, southeastern Oregon, southern Idaho, southeastern Washington from Wallula to Walla Walla, and to the Yakima Valley of Washington and the Okanogan Valley of Washington and British Columbia.

Specimens examined.—Washington, 5 ♂ ♂, 2 ♀ ♀; Oregon, 11 ♂ ♂, 8 ♀ ♀; Idaho, 2 ♂ ♂; Nevada, 35 ♂ ♂, 14 ♀ ♀ (including type). Doubtful intergrades, nearest *solitudinis*: Washington, 17 ♂ ♂, 15 ♀ ♀. Intergrades with *grinnelli*: 13 ♂ ♂, 1 ♀. Intergrades with *frontalis*: Utah, 17 ♂ ♂, 10 ♀ ♀; Arizona, Coconino and Mojave counties, 2 ♂ ♂. Intergrades with *grinnelli* of central and southern California: San Joaquin Valley, 4 ♂ ♂; Los Angeles County, 2 ♂ ♂, 1 ♀; SE. California, 5 ♂ ♂, 4 ♀ ♀. Intergrades with *ruberrimus*: extreme SE. California, 13 ♂ ♂, 5 ♀ ♀; W. Arizona, 1 ♂; NW. Sonora, 9 ♂ ♂; NE. Lower California, 7 ♂ ♂, 2 ♀ ♀.

I have remarked elsewhere that the paleness of this race is probably due to the extreme aridity and to other meteorological factors of the Great Basin region. By way of the ten and fifteen inch rainfall areas, *solitudinis* inosculates with other races to the east, south and west. A striking example is the penetration through the Mojave Desert into the ten inch area of the San Joaquin Valley, and into Modoc County of northeastern California.

Carpodacus mexicanus grinnelli Moore
Grinnell House Finch

Carpodacus mexicanus grinnelli Moore, Proc. Zool. Soc. Wash., vol. 52, p. 109, June 24, 1939, Scott River, 6 mi. NW Callahan, Siskiyou County, California; type in Mus. Vert. Zool.

Subspecific characters.—A medium sized bird like *frontalis* and *solitudinis;* it differs from both in being more extensively red both above and below in all plumages, with crown more solidly red, and from *solitudinis* in less whitish ground color and wider streaking. It differs from *frontalis* especially in more pinkish buff ground color, and in less whitish nuptial plumage.

Range.—Characters best developed in the forty to eighty inch rainfall areas (U. S. Dept. Agric., 1922, pp. 6-7) of the Transition Zone of southwestern Oregon and northern California; thence it extends throughout the Upper Sonoran Zone of California, except in northeastern California and the Mono Lake region, and also into portions of the Lower Sonoran Zone, south to the San Pedro Mártir Mountains and the northwestern coast of Lower California as far as latitude 28°; also occurs on Farallon Islands, northern members of Santa Barbara island group, Todos Santos and Cedros islands.

Remarks on range.—In a previous paper (*loc. cit.*) I have stated my belief that *grinnelli* and *solitudinis* intergrade with each other in several sections of the ten and fifteen inch rainfall areas of California. The localities where intergrades have been taken are shown on the distribution maps (figs. 35, 36) by circles, whereas true *grinnelli* is represented by dots in the forty to eighty inch rainfall area of California and Oregon, and in the fifteen to forty inch area in southern and Lower California.

Specimens examined.—Vancouver Island, 2 nestlings; Washington, 1 ♀; Oregon, 6 ♂ ♂, 3 ♀ ♀; California, 158 ♂ ♂ (including type), 32 ♀ ♀; Lower California, 8 ♂ ♂, 1 ♀.

Remarks on nomenclature.—*Carpodacus purpureus* var. *californicus* of Brewster (1877, p. 37) is merely a misidentification without nomenclatural standing.

Pyrrhula inornata Vigors (1839, p. 20) must be considered. Sclater (*in* Sharpe, 1888, p. 139) stated that this type "has disappeared"; he judged it to be a *"Spermophila* or *Guiraca."* I follow Grinnell (1932, p. 303) in so far as he gives no consideration to Sharpe's suggestion. The descriptive phrase, *"subtus albescens,"* certainly rules out the last, and the large measurements the first. Ridgway's rather arbitrary placement of this citation in the synonymy of *Carpodacus mexicanus frontalis* Say, when two other species of the genus *Carpodacus* have an equal claim for consideration, calls for reëxamination. Certain data must be kept in mind: (1) The measurements, when reduced to the metric system, are, length of body, 120.61 mm., wing 76.18 mm., bill 12.70 mm., tail 57.13 mm., and tarsus 19.04 mm. (2) A phrase from the Latin description reads, *"subtus albescens, brunneo maculata."* (3) If the bird were a member of the genus *Carpodacus,* which is all that concerns us in this paper, it was a female. (4) It was taken between October 9 and March 18 (almost certainly before January 27), during which period the bird must have been in unworn winter plumage. (5) Since no race of *Carpodacus* of the large size and description given above could have been taken at Acapulco, San Blas or Mazatlan, the possible localities which members of the party on H. M. S. Blossom (Beechey, 1831) visited can be reduced to the city of Tepic, Monterey and San Francisco. The occurrence of the Cassin Purple Finch on the Tres Marias Islands (McLellan, 1926, p. 306) represented a vagrant and does not imply the probability that the species could have been taken at San Blas or Acapulco, where no form of *Carpodacus* has been recorded.

Admitting that descriptions were carelessly made a century ago, nevertheless, we are bound by this description, since the type has disappeared, and we certainly have no right to invent a different description to suit some preconceived idea of the identity of the type. The large size of the bill and the tarsus eliminates every race of *Carpodacus mexicanus,* except *amplus,* and the Blossom did not visit Guadalupe Island. Furthermore, *"subtus albescens"* does not describe the female of *amplus* at any time of the year, nor the female of any other *C. mexicanus,* least of all in the winter months. This phrase does describe the female either of the Cassin Purple Finch or of the California Purple Finch, even in winter plumage, and four of the five measurements fit the latter best; the fifth measurement,

that of the bill, if it was measured from the rictus, would also apply. Finally, the California Purple Finch does occur in the vicinity of San Francisco in the winter months. I therefore suggest the elimination of *Pyrrhula inornata* Vigors from the synonymy of *Carpodacus mexicanus* and its races, and leave it to some future reviewer to decide whether the Latin name of the California Purple Finch should be changed.

Although we are still in doubt as to the racial identification of the birds of northeastern Washington, the unbroken occurrence of white-bellied birds from eastern Oregon and Nevada through southeastern California to northeastern Lower California, indicates that the ranges of *grinnelli* and *frontalis* are separated, and that the area between is occupied by *solitudinis*, a bird which is far more different from either of them, than *grinnelli* is from *frontalis*. I have pointed out in the original description of *grinnelli* (*loc. cit.*) that Ridgway's failure to recognize this form was due to his unfamiliarity with the relatively great extent to which the red is gradually worn away from November to June. This wearing has been described by recent investigators (Grinnell, 1911, Michener and Michener, 1931, and Moore, 1936).

It is rather surprising that as we proceed south through California into Mexico we do not find the red extending farther on to the posterior under parts, as is the case with the birds both of the plateau and the desert groups. *Mcgregori* and *amplus* are much less extensively red than *grinnelli* of southwestern Oregon. The extensively red bird of eastern and southern Lower California, belongs to the desert group, as shown by its identity with the bird of Sonora.

Carpodacus mexicanus clementis Mearns
San Clemente House Finch

Carpodacus clementis Mearns, Auk, vol. XV, July, 1896, p. 258. San Clemente Island, California; type in U. S. Nat. Mus.

Subspecific characters.—Nearest to *C. m. grinnelli* of the mainland, but bill larger on the average; in adult males the ground color of posterior under parts and sides slightly more buffy and streaks slightly wider; adult females more Drab, rather than Drab-gray above; ground color of under parts decidedly more buffy; streaks Drab rather than Hair Brown and wide.

Range.—San Clemente Island, where its characters are expressed best. Birds of Catalina, Santa Barbara, San Nicolas, and Los Coronados islands are variously intermediate toward *grinnelli*.

Specimens examined.—Santa Catalina Island, 4 ♂ ♂, 1 ♀; San Clemente Island, 53 ♂ ♂, 17 ♀ ♀; Santa Barbara Island, 3 ♂ ♂, 1 im. ♂, 2 ♀ ♀; San Nicolas Island, 12 ad. ♂ ♂; Los Coronados Islands, 3 ♂ ♂, 1 ♀, 1 jv.

Clementis is certainly one of the weaker races of the *mexicanus* group, but the buffier coloration of the adult females, which does not seem to have been emphasized, is conspicuous in the large comparable series of worn March and April birds which I have inspected. In this character even Santa Cruz Island females (I have seen only four adult March birds), although grayer above and showing whiter ground color below, have wider and more Drab streaks on the anterior under parts than mainland birds, but they are slightly closer to *grinnelli* than to *clementis*. Only two comparable adult females from Santa Barbara Island have been inspected by me, and these two happen to be close to *grinnelli*, having the smaller bill as well as less Drab (grayer) coloration and finer streaking.

I cannot perceive that the red or yellow coloration of the adult males is more brilliant than in *grinnelli* when birds of the same stage of wear are compared. The best characters are discernible in the females. The extraordinarily large proportion of yellow and orange males should not be too much undervalued in view of the fact that this is an important character of another island form, *C. mutans*, where all nineteen males exam-

ined have this coloration. Granting that young birds are more apt to be yellow (Michener and Michener, 1931), the contrast between *clementis* and *grinnelli* is still extraordinary. Seventy-three per cent of 53 adult San Clemente males have some yellow or orange coloration, whereas only 16 per cent of 176 mainland birds have it.

The opinions of numerous authors (Mearns, 1898, Grinnell, 1915, Howell, 1917, Dawson, 1923, van Rossem, 1925 and Willett, 1933) should all be weighed in evaluating *clementis,* since each may have inspected a different series.

Carpodacus mutans Grinnell
Hawaiian House Finch

Carpodacus mutans Grinnell, Auk, vol. 29, January, 1912, p. 24. Haiku, Maui, Hawaiian Territory; type in Mus. Vert. Zool.

Specific characters.—Resembles in winter plumage *Carpodacus m. grinnelli* of California, but differs in having yellow or orange rather than crimson coloration; occiput brown, not colored; streaking of posterior under parts much more sharply outlined; ground color of posterior under parts more yellowish (Ivory Yellow instead of Tilleul-Buff).

Range.—Confined to the Hawaiian group, appearing at least on the islands of Oahu, Molokai, and Hawaii.

Specimens examined.—Hawaiian Islands: Oahu, 3 ♂ ♂; Molokai, 12 ♂ ♂, 6 ♀ ♀; Paloan, 2 ♂ ♂; Kauluwai, 1 ♂; Hawaii, Olaa, 1 ♂.

Phillips (1912) doubted the wisdom of employing the name *mutans,* and also seemed to question the validity of the species itself. It seems to me the only question of importance to the systematist is whether the birds, as they exist today, show the differences emphasized by Grinnell, regardless of what the characters may have been when they were first introduced. The two series which I have examined, namely, seven birds in the collection of the Museum of Vertebrate Zoology and eighteen in the Museum of Comparative Zoology, reveal the character claimed by Grinnell.

It seems to me that two other characters have been overlooked. In the males in the series in the Museum of Vertebrate Zoology, the outer primary is the longest, and the next ones (9, 8, 7 and 6) are shorter in regular order.

An interesting table was prepared by Grinnell (1911, p. 193), by which he attempts to correlate different types of abnormal coloration with climatic areas.

Carpodacus mexicanus nigrescens Griscom
Tamaulipas House Finch

Carpodacus mexicanus nigrescens Griscom, Amer. Mus. Novit., no. 293, p. 5, January 12, 1928. Miquihuana, Tamaulipas, Mexico; type in Amer. Mus. Nat. Hist.

Subspecific characters.—Griscom says, "Similar to *Carpodacus mexicanus potosinus* . . . , but adult male even darker throughout, the red areas slightly so, but upperparts, primaries and streaks below dark fuscous or blackish brown; adult female and young of both sexes also darker in some respects."

Range.—Known only from the type locality. Apparently only four specimens have been taken.

Specimens examined.—Tamaulipas, Miquihuana, 1 ♂ (type), 1 ♂, 1 ad. ♂, 1 jv. ♀.

The type shows clearly the characters given by Griscom. It is as dark on the wings, tail and upper parts, as the blacker individuals from the coal regions of central Colorado. From the examination of two males only, this would seem to be a very well marked race, the blackest of all the races of *mexicanus*. The under parts are dark red even in worn July plumage. At this time of year, when normally the red is brightest, in this race it is as dark as Carmine. It extends posteriorly only as far as the anterior line of the abdo-

men and does not appear on the under tail coverts. On the upper parts it shows in an obvious suffusion. The juvenile from Miquihuana approximates a female of *potosinus*. A male from the type locality with throat, forehead and rump yellow, taken July 5, has the wings, tails and streaking below much browner than in the type. The measurements are approximately those of the northern races of the United States, but as in all Mexican races, the wing is proportionately shorter in relation to the tail, so that the difference between them is only slightly greater than the length of the tarsus. The streaking on the under parts is broadly and sharply outlined. *Nigrescens* occurs in a forty to sixty inch rainfall area, which circumstance seems to have affected its coloration.

Carpodacus mexicanus potosinus Griscom
San Luis House Finch

Carpodacus mexicanus potosinus Griscom, Amer. Mus. Novit., no. 293, p. 5, January 12, 1928. San Luis Potosi, Mexico; type in Mus. Comp. Zool.

Subspecific characters.—Adult male in winter plumage not nearly so dark above or below as *Carpodacus m. nigrescens*, the red areas being approximately Carmine as compared with Oxblood red; wings and tail browner; most specimens with very little suffusion of red on crown, occiput and back; red on anterior under parts extends to about middle line of chest; streaking narrower; size slightly larger.

Range.—State of San Luis Potosi, Mexico, north through Nuevo Leon and at least eastern Coahuila to Kinney and Valverde counties, Texas, and to extreme northeastern Chihuahua.

Specimens examined.—San Luis Potosi, 11♂♂, 5♀♀; Nuevo Leon, 1♂; western Texas, 7♂♂, 11♀♀; northeastern Chihuahua, 1♂.

Potosinus is an excellent race, strongly differentiated from its neighbor to the south, *centralis* of Guanajuato, and even more so from its neighbor to the southeast, *C. mexicanus mexicanus* of Hidalgo. Specimens from Kinney County, Texas, are almost identical with *potosinus* from San Luis Potosi, differing only in slightly smaller dimensions. The same is true of the individual from Valverde County. A comparable series of males and females taken from February to April show the slightly buffy ground color of the posterior under parts of *potosinus*, which is white in *frontalis* intergrades taken in May from western Brewster County. From Valverde County west to El Paso County there is a large area in southwestern Texas from which the specimens are paler in ground color below and redder in the dark area than either *frontalis* or *potosinus*. They approach, slightly, *coccineus* of Jalisco. They may represent intergrades between *frontalis*, *potosinus* and the intermediates of San Feliz in southern Chihuahua. Unfortunately there are not sufficient specimens available to work out the distributions and I venture only to suggest that *potosinus* may extend as far west as Marathon in Brewster County. An individual from Presidio County is placed in *potosinus* provisionally.

No specimens are available from between Kinney County, Texas, and Cienaga de las Flores, twenty miles north of Monterrey, Nuevo Leon. At the latter locality George Miksch Sutton collected a single bird which seems definitely to be *potosinus*. I have seen no specimens from eastern Coahuila, but a male (January 11) from Chupadero, northeastern Chihuahua, is almost true *potosinus*. It would seem, then, that western Coahuila should be inhabited by *potosinus*.

Carpodacus mexicanus centralis Moore
Guanajuato House Finch

Carpodacus mexicanus centralis Moore, Condor, vol. 39, September, 1937, p. 204. Guanajuato, Mexico; type in U. S. Nat. Mus.

Subspecific characters.—Largest of all the forms of the subgenus *Burrica*, even exceeding *amplus* of Guadalupe Island in all measurements, except size of bill; males with great extension of Prussian

to Ocher Red on under parts, including, in early winter plumage, almost all the abdomen as well as under tail coverts. It is closest in this to the smallest of all races, *rhodopnus* of Sinaloa, but in the nuptial plumage it differs, the red being worn away on portions of the lower abdomen. In nuptial plumage the color below is Spectrum Red to Carmine as compared with Rose Red and the streaking on posterior under parts is more prominent.

The accession of a fresh series of thirty-three specimens, representing all plumages, makes possible a more detailed comparison than was made in the original description. Compared with *potosinus*, males in winter plumage are much more extensively red below; much darker above because of the heavy suffusion of red on all upper parts; streaking much less conspicuous, being hidden by the red suffusion, but not in nuptial plumage; ground color of posterior under parts more Pinkish-Buff, but in worn nuptial plumage Vinaceous-Buff to Tilleul-Buff. Females in fresh winter plumage in the fall, apparently *darker* above; streaking wider and more sharply outlined on under parts; ground color between Pinkish-Buff and Cinnamon-Buff on lower flanks; Tilleul-Buff on anterior under parts.

A rather unusual characteristic, brought out by the new series, is the rather definite streaking of the upper parts of both males and females in winter plumage. This is the only race which approaches the purple finches in this respect.

Range.—State of Guanajuato, Mexico, and northern Michoacan.

Specimens examined.—Guanajuato, 25 ♂ ♂, 11 ♀ ♀; northern Michoacan, 3 ♂ ♂, 1 ♀.

When one considers that *centralis, potosinus* and *C. mexicanus mexicanus* of Hidalgo occupy a triangle with the three corners not over 200 miles from each other, the distinctness of these forms seems extraordinary. This is particularly so in comparison with the three northern races of the United States which spread over a territory 1400 by 700 miles, and which have the same measurements and differ only to a moderate degree in coloration. *Mexicanus* is the least extensively red of all races and *centralis* is the most red, barring one, *rhodopnus*.

Nine individuals are at hand from Rancho Enmedio in the Sierra de la Media Luna, thirty-five miles from the boundary of the state of San Luis Potosi. Two of the males have the less restricted red and smaller size of *potosinus*; the other three males are closer to *centralis*. Three males from San Augustin at the southwest end of Lake Cuitzeo, Michoacan, although very slightly smaller, are almost typical *centralis*.

Carpodacus mexicanus coccineus Moore
Scarlet-breasted House Finch

Carpodacus mexicanus coccineus Moore, Proc. Zool. Soc. Wash., vol. 52, July, 1939, p. 128. "Mts. of Colima," Colima; type in U. S. Nat. Mus.

Subspecific characters.—In nuptial plumage resembles most closely *Carpodacus m. potosinus*, but differs in having red worn nuptial plumage Scarlet, as compared with Nopal Red; ground color of upper parts distinctly paler, Drab as compared with Benzo Brown, suffused with Scarlet instead of Scarlet Brown; ground color of posterior under parts whiter; size about same. Females, in worn nuptial plumage, seemingly with upper parts paler, more Drab as compared with Fuscous; ground color of under parts whiter.

Range.—Mountains of Colima, western Jalisco and Nayarit north to Tepic and Guadalajara, east through Jalisco at least to La Barca, possibly to Patzcuaro, Michoacan. The northern Jalisco (Bolanos and Colotlan) and southern Durango birds are intergrades with *centralis*, but are closer to *coccineus*.

Specimens examined.—Colima, 1 ♂ (type); Jalisco, 13 ♂ ♂, 5 ♀ ♀; Nayarit, 9 ♂ ♂, 4 ♀ ♀; Michoacan, 1 ♂. Intergrades with *potosinus*: Durango, 2 ♂ ♂, 3 ♀ ♀.

This bird is the most brilliantly scarlet race in nuptial plumage of any of the house finches. From the geographically closest bird to the east, namely *centralis* of Guanajuato, it is distinguished by its smaller size, brighter coloration, and much less extensively red under parts. It is closest to the geographically more distant bird to the northeast, *potosinus* of San Luis Potosi, but differs as described above.

Carpodacus mexicanus altitudinis new subspecies
Sierra Madre House Finch

Type.—Male adult, in annual molt, no. 18503, collection of Robert T. Moore; San Feliz, Chihuahua, Mexico, on Chihuahua-Sinaloa state line, due east of Tepetuco, Sinaloa, Mexico; altitude "about 7500 feet;" August 20, 1936; collected by Chester C. Lamb.

Subspecific characters.—Very small size, almost as small as *rhodopnus* of the coastal plains of Sinaloa, but differs in much less extensively red coloration below; streaks on posterior under parts exceedingly wide, whereas streaks almost absent in *rhodopnus*. Females much more widely streaked below and darker, the markings almost as dark brown as in *centralis*.

Differs markedly from *coccineus* to the south, in being much smaller (wing 72.8 compared with 79.3); red coloration darker, less Scarlet. In females and immature males streaking below much wider than in a September bird from Jalisco. To the north, two October specimens taken October 7 at Batopilas in the great arid canyon of southwestern Chihuahua are *Carpodacus m. ruberrimus*, being more finely and obscurely streaked below and somewhat less extensively red than *altitudinis*. The females from the same place differ in a very much narrower streaking below. To the east, the series from Durango shows much larger dimensions and lighter streaking.

Range.—Undoubtedly confined to a few favorable places at high altitudes (7500 feet) in the Sierra Madre which divides Sinaloa from Chihuahua and Durango. The northern and southern extensions along the range are unknown, but it does not reach as far south as Tepic, Nayarit.

The range of *altitudinis* seems to parallel that of other races that are restricted to the heavy rainfall areas of the western slopes of the Sierra Madre, such as *Otus asio vinaceous*. These forms are markedly different from their relatives of the more arid Mexican plateau to the east and of the arid coastal plains to the west.

Specimens examined.—Chihuahua, San Feliz, 4 ♂♂, 3 ♀♀, 2 im. ♀♀. Intergrades closer to *potosinus*: Durango, Papasquiaro, 1 jv. ♂, 1 jv. ♀; Durango City, 1 ♂, 2 ♀♀; Guanacevi, 1 ♂; Opito, 3 ad. ♂♂, 2 im. ♂♂, 1 ad. ♀, 1 im. ♀. Chihuahua, San Francisco Mines near Parral, 5 ad. ♂♂, 1 ♀.

This dark, heavily streaked race is apparently confined to the lower Transition Zone of the Sierra Madre. I have flown over the type locality twice and have camped within approximately fifteen miles of it in an air line on Mt. Mohinora, in May, 1937. As has been indicated in a previous article (Moore, 1937a, p. 95), there is no doubt that the entire area from San Feliz to Mt. Mohinora is one of heavy rainfall which probably approximates a mean annual total of forty to sixty inches. Nearby areas have been recently so mapped (Brooks, 1936, map 14). This contrasts with twenty-one inches at Tascate, 75 miles to the northeast, and with eighteen inches at Parral, 125 miles farther east in Chihuahua. To the west in southern Sonora, near Alamos, it is only fifteen inches. San Feliz is one of the highest points at which the house finch has been found nesting (see F. M. Bailey, 1928, p. 690).

It would be desirable to have adequate series taken at other periods of the year, but fortunately there is comparable material showing the same early winter plumage (late July to early October), for every race that adjoins *altitudinis*. *Altitudinis* is certainly not an intergrade, for males, females and immatures are less extensively red and are darker and more widely streaked below than are similar series of *rhodopnus* to the west, and than series of *coccineus*. The much larger birds of the semi-arid plateau of Durango to the east are intergrades with *centralis*, and are somewhat smaller in size and less extensively red.

The series from the San Francisco Mines in Chihuahua clearly has affinities with *potosinus*, being less extensively red and smaller than the Durango birds, but more extensively red and much larger than *altitudinis*. They are intermediates between *altitudinis* and *potosinus*.

Carpodacus mexicanus rhodopnus Moore
Sinaloa House Finch

Carpodacus mexicanus rhodopnus Moore, Condor, vol. 38, 1936, p. 203. El Molino, Sinaloa, Mexico; type in coll. Robert T. Moore.

Subspecific characters.—Smallest, most extensively red and least streaked of all the races of *mexicanus;* entire under parts in winter plumage, and almost invariably in nuptial plumage, including under tail coverts as well as back, suffused with various hues of red. Differs from all preceding races in that the difference between wing and tail noticeably less, and tarsus relatively longer; difference in wing and tail less than the length of tarsus instead of more.

Range.—Approximately the central third of Sinaloa from the coast to an altitude of about 3000 feet and from El Molino and Palmar in the south near latitude 24° north approximately to the Sinaloa River.

Rhodopnus may be found sporadically as far south as Quelite near the Tropic of Cancer, as C. C. Lamb reports a sight record for that place. It is possible to define the range of *rhodopnus* more precisely than that of any other mainland race of *Burrica.* North and northwest of the range of true *rhodopnus* lies a strip of territory ranging north of the Sinaloa River, approximately fifty miles in length, in which intergrading forms with *ruberrimus* have been found, for example at Naranjo and Ahome in the extreme northwestern corner of the state. The birds of Yecorato, east of the Fuerte River, are definitely *ruberrimus,* having the posterior under parts in nuptial plumage largely white, or pinkish white. *Rhodopnus,* unlike *ruberrimus,* does not seem to be migrant.

Specimens examined.—Sinaloa: 28 ♂ ♂ (including type), 13 ♀ ♀. Intergrades with *ruberrimus,* 2 ♂ ♂, 3 ♀ ♀. Migrants from intergrading area to north: Palmar, 1 ♂, 1 ♀; Guamuchil, 1 ♂ (March 19); Culiacan, 2 ♂ ♂ (January 30, March 1); El Molino, 1 ♂ (February 10).

Since *rhodopnus* was described (Moore, 1936), more specimens have become available from all over Sinaloa, except for the puzzling gap in the distribution of the species that lies between a point south of Palmar and the southern boundary of the state. Of the twenty-eight adult males, ten are in nuptial and eighteen in winter plumage. All of these are completely red from chin to under tail coverts, including abdomen. The race is extremely well marked in nuptial plumage.

The most southern point at which we have taken a specimen is Palmar, about latitude 24°30′, in a gap in the mountains where the altitude is only about 800 feet. We have never taken it higher than at Rancho El Padre, 3000 feet, near latitude 26° which is the northern limit of the race. None of the five specimens from this locality shows any tendency to intergrade toward *altitudinis* of the high mountain area (7500 feet). The type locality of *altitudinis* is only thirty-eight miles east of El Padre.

Rhodopnus seems to represent the most southwesterly extension of a movement which may have had its origin in the depressed temperatures of the glacial period and which may have pushed the species down on to the Nevada-California deserts and the coastal plains of Sinaloa and Sonora. Throughout the vast arid belt occupied by the desert group, the ground color of the posterior under parts remains almost pure white, but the birds become smaller and more extensively red as we go south to approximately the latitude of Guaymas, where the mean annual rainfall increases to about ten inches. At Culiacan near the type locality of *rhodopnus* the rainfall rises to twenty-one inches, and the white ground color darkens to Pale Vinaceous-Fawn and the bird is now completely incarnadined. Although I believe that the extreme arid conditions of this belt affect the size and paleness of coloration of these races, the increasing extension of the red is due to some unknown cause. This is indicated by the fact that to the south in the mountains of Colima, the type locality of *coccineus,* where the annual rainfall is much greater, thirty to fifty inches, the birds are not nearly so extensively red as in *rhodopnus.*

In company with Arthur Barr and Chester Lamb, I found quite a colony of this race breeding at Reforma, Sinaloa, in May, 1938, under the thatched roofs of huts. A set of four eggs was taken.

Carpodacus frontalis ruberrimus Ridgway
San Lucas House Finch

Carpodacus frontalis ruberrimus Ridgway, Man. N. Amer. Birds, 1887, p. 391 (footnote). Cape San Lucas=La Paz, Lower California; type in U. S. Nat. Mus.

Carpodacus mexicanus sonoriensis Ridgway, Birds N. and Middle Amer., part 1, 1901, p. 135; no type designated.

Subspecific characters.—Differs from *C. m. rhodopnus* in nuptial plumage in less extensive red of under parts, the abdomen with little red coloration but often a suffusion on the flanks; streaks of abdomen obvious, instead of almost completely concealed; color of red on under parts brighter, Nopal Red instead of Carmine.

In winter plumage, *ruberrimus* is considerably brighter, when a series for each month of the year is compared. For example, January birds are much more rosy pink, whereas *rhodopnus* is Burnt Carmine to Wine Purple. The upper parts average less reddish and slightly paler brown. Adult females, from March to May, do not differ greatly, but *ruberrimus* has wider, somewhat less numerous, streaks on under parts.

Range.—Characters most extreme in Cape San Lucas region; ranges north along interrupted stretches of coastal plains of eastern Lower California at least to Mulegé, latitude 26° 54′; in central and western portions of southern half of Lower California, north to about latitude 28°; also from the Rio Fuerte, extreme northern Sinaloa, north on coastal plains about to Guaymas, Sonora, latitude 28°, east to a low altitude (about 2000 feet) in the foothills.

Birds of northeastern Lower California and northern Sonora are intergrades with *solitudinis*.

Specimens examined.—Lower California, 115 ♂ ♂, 48 ♀ ♀ (including type), plus large series in M. C. Z. and Brit. Mus. Also, nearly 100 specimens from west-central and southern Sonora, southwestern Chihuahua and extreme northern Sinaloa. Migrants in northern Sinaloa, 2 ♂ ♂.

In a former paper (Moore, 1936), on the basis of 95 specimens of *ruberrimus* from Sonora and Lower California, I agreed with the conclusion reached much earlier by Brewster (1902, p. 134) that both so-called *sonoriensis* and the birds of the Cape Region of Lower California are "referable to the same form (*ruberrimus*)." Since then I have had the opportunity to see a great many more specimens in the Smithsonian Institution, the British Museum and notably in the Museum of Comparative Zoology at Cambridge. These specimens are so numerous that I have not attempted to list them. Brewster called attention to the fact that the "birds of the two regions, as represented in my [his] collection, do not show (even by averages of measurements) the difference in respect to the length of the wings and tail which Mr. Ridgway has noted." He conceded that, " as a rule, my examples from the Cape Region are characterized by somewhat thicker or more swollen bills than are possessed by those which I have received from Guaymas and Alamos, Sonora. . . . " A much larger series now available makes even this character disappear; the height of the bill at the base is just about the same; the length of the exposed culmen may be one-third of a millimeter longer.

Regarding the criticism that Ridgway named no type of *sonoriensis*, Major Goldman, Dr. Friedmann and Dr. Oberholser all expressed to me the conviction that no. 164324, Biol. Survey Coll. *was* chosen by Ridgway as the type. It is so marked on the original tag in handwriting, which Major Goldman believes is Nelson's, and he adds that Nelson always regarded it as the type. Furthermore, Friedmann showed me the card in Richmond's copy of the "card catalogue," which definitely proves that this coworker with Ridgway, who specialized in research on types, described it in his handwriting as the "type." It still seems to me that the use of separate names for *ruberrimus* and the birds of southern Sonora would obscure an exceedingly interesting result of the directing power of similar climatic environments, rather than help to elucidate it. Therefore, I am reducing *sonoriensis* to the synonymy of *ruberrimus*.

In order to ascertain which group of birds on the east coast of the Gulf of California most closely resembles those of the Cape region of Lower California (type locality of

ruberrimus), I grouped together all the specimens from this latter region from Cape San Lucas, latitude 22°52′, to latitude 26°. These cover a section approximately comparable in size to the range of *rhodopnus* across the Gulf. One would expect these Cape region birds to show approximately the same average size. Instead, they are larger, having almost exactly the measurements of the birds occurring between Alamos and Guaymas, that is, from latitude 27° to latitude 29°. It may be more than a coincidence that the mean annual rainfall for the region between Hermosillo (175 mm.) and Guaymas (283 mm.) is much closer to that of La Paz (142 mm.), than to the very much greater rainfall in the Culiacan region of Sinaloa (542 mm.).

Ruberrimus, like *rhodopnus*, differs from the races farther north in having the tarsus longer than the difference between the wing and the tail.

Grinnell (1928, pp. 9-10) has stated that only three differentiates have come into Lower California and established themselves as "vagrants" via the water route from the mainland. It is probable that *Carpodacus* arrived by the northern route and like many other groups became differentiated in the Cape district. It is of interest to students of zoogeography to note that Schuchert (1935, map no. 14, series following p. 767) has shown that as late as the Lower and Middle Miocene the water surface of the Gulf of California was reduced almost one-half and the upper one-third was land.

Carpodacus mcgregori Anthony
San Benito House Finch

Carpodacus mcgregori Anthony, Auk, vol. XIV, April, 1897, p. 165. San Benito Island, Lower California; type in Carnegie Mus., Pittsburgh.

Specific characters.—Bill much larger than in *C. mexicanus*. Resembles most closely *C. m. clementis*, but in males in March at least, darker above; streakings below somewhat wider; red or yellow coloration somewhat less extensive; bill and tarsus larger; females in March seem to be much more widely streaked below and darker above. Differs even more in the same characters from *grinnelli*, having red much less extensive on under parts and seldom any on back. Almost all of the males I have seen are yellow or orange-yellow.

Range.—As a breeding bird, apparently confined to San Benito Island, but vagrants (Grinnell, 1928, p. 155) occur on Cedros Island.

Specimens examined.—Lower California, San Benito Island, 7 ♂ ♂, 6 ♀ ♀.

Remarks.—I find the length of wing and tail only very slightly larger than in *grinnelli* of northwestern California; *mcgregori* are somewhat larger than *grinnelli* from northwestern Lower California, the wing being 2 mm., and tail 1.9 mm., longer.

Carpodacus amplus Ridgway
Guadalupe House Finch

Carpodacus amplus Ridgway, Bull. U. S. Geol. and Geog. Surv. Terr., vol. II, April, 1876, p. 187. Guadalupe Island, Lower California; type in U. S. Nat. Mus.

Specific characters.—Resembles most closely *C. mcgregori*, but size larger, the bill especially; upper parts much darker brown without suffusion of red; under parts more widely streaked in males only.

Range.—Confined to Guadalupe Island, Lower California.

Specimens examined.—Guadalupe Island, 38 ♂ ♂, 1 im. ♂, 25 ♀ ♀.

Remarks.—It is interesting to note that although the wing and tail are longer than in the northern races, including *grinnelli* of California, the tarsus is also proportionately longer, so that the tarsus is almost exactly the same length as the difference between the wing and tail, whereas in California birds and other northern races, it is shorter.

Carpodacus mexicanus mexicanus Müller.
Mexican House Finch

(*Fringilla*) *mexicana* Müller, Syst. Nat. Suppl., 1776, p. 165 (based on *Bruant, de Mexique Buffon*, Pl. Enl., vol. VI, pl. 386, fig. 1).

C(*arpodacus*). *rhodocolpus* Cabanis, Mus. Hein., vol. I, August, 1851, p. 166. "Mexico," that is, Cuernavaca, Morelos; type in Berlin Mus.

Fringilla haemorrhoa Lichtenstein, Preis-Verz. Mex. Vög., 1830, p. 2. Mexico; type in Berlin Mus.

Subspecific characters.—Differs from all of the known races of *Carpodacus mexicanus* in having red both above and below very much restricted and sharply defined; red of forehead confined to U-shaped pattern, the uprights of the U consisting of broad superciliary stripes extending to the end of the postauricular region; red on under parts confined to chin and throat; no suffusion of red whatever on the rest of upper parts, not even on the occiput; size large, wings and tail about equal to *amplus*, smaller than *centralis;* bill large, but not nearly so large as in *amplus;* ground color of posterior under parts more buffy than in other races, the flanks ranging from Pinkish Buff to Clay Color; streaks on under parts of medium width.

Range.—Hidalgo, Mexico, a portion at least of Veracruz, District Federal, Tlaxcala, Puebla and Morelos.

Specimens examined.—Hidalgo, 3 ♂ ♂, 3 ♀ ♀; Veracruz, 4 ♂ ♂, 2 ♀ ♀; Mexico, 10 ♂ ♂; Puebla, 5 ♂ ♂, 4 ♀ ♀; Morelos, 7 ♂ ♂, 3 ♀ ♀; northwestern Oaxaca, 2 ♂ ♂.

I herewith restrict the type locality of (*Fringilla*) *mexicana* Müller to the Valley of Mexico, Mexico, a place from which the type might have come.

Van Rossem (1934, pp. 419-421) has shown that both *C*(*arpodacus*). *rhodocolpus* Cabanis and *Fringilla haemorrhoa* Lichtenstein are synonyms of (*Fringilla*) *mexicana* Müller.

C. m. mexicanus is found in areas that receive thirty to sixty inches of rainfall annually. This probably has had some effect on the dark ground color of the posterior under parts.

I have stated previously that as we proceed from the United States south through Mexico, we find the house finches more extensively red on the under parts; this reaches a climax in *centralis* of Guanajuato. Then suddenly we come upon *C. m. mexicanus*, the least extensively red race. A recent expedition to Guanajuato proves that they approach each other to within one hundred miles. No intergrade has yet been taken, although there is still some territory to explore. One must conclude that something extraordinary has happened to create such a sudden change. This bird may not be conspecific with *centralis* and the other races to the north. Should no intergrade be taken, after the small zoologically unexplored areas have been thoroughly combed, I feel that we will have to accord *mexicanus* full specific distinction.

Carpodacus mexicanus roseipectus Sharpe
Oaxaca House Finch

Carpodacus roseipectus Sharpe, Cat. Birds Brit. Mus., vol. XII, 1888, p. 424. Oaxaca, southern Mexico; type in Brit. Mus.

Subspecific characters.—According to Sharpe (1886, p. 424) differs from *C. m. mexicanus* in having the "forehead deep crimson" . . . ; "cheeks and throat dark crimson, the latter well defined" . . . ; "breast" . . . "all washed with pale rose-colour" . . . , and "under tail-coverts whity brown, washed with rosy. . . ."

Range.—Known only from type locality, "Oaxaca" (=Oaxaca City), Oaxaca, Mexico.

Specimens examined.—None. See note below on examination by van Rossem of British Museum specimens and the type.

The two specimens from "Huajualpam" (de León), Oaxaca, which Ridgway (1901, p. 133) listed under *C. m. roseipectus*, and which were the only ones he had inspected,

prove to be typical *C. m. mexicanus*. They have the flanks and under tail coverts Cinnamon Buff. These Huajuapan specimens were both taken on November 18 by Nelson and Goldman. It is probable that Ridgway thought they were taken at the Huajuapan in extreme southeastern Oaxaca, about sixty miles due east of Tehuantepec City. In a recent letter, Major Goldman assures me they were not, but were collected in Huahuapan de León in extreme northwestern Oaxaca almost on the boundary with Puebla. This probable error was undoubtedly the cause of Ridgway's skepticism (*loc. cit.*), and has been responsible for the doubt concerning this form that has existed since then.

Although I have examined no specimens of *roseipectus* for the purposes of this paper, Mr. A. J. van Rossem in an exchange of courtesies, has offered me the opportunity of quoting from his notes made in the "British Museum - - - May 18, 1938." These show that the type of *Carpodacus roseipectus* Sharpe is very different from the two Huajualpam males inspected by Ridgway. After giving the measurements of this specimen as "Brit. Mus. (No.) 85.12.14.1146, wing 76, tail 61, exp. culmen 10.5, depth at base 8.7, tarsus 18.0, middle toe minus claw 14.8, Fenochio, Oaxaca—W. Mexico," van Rossem adds, "Skin in good condition. Looks as though collected in midwinter or early spring. There is an *orange-red flush* [italics mine] over the *whole* of the under parts—very faint on abdomen and flanks—strongest on chest. Otherwise, like mexicanus, particularly in the sharply defined throat patch." Then van Rossem adds, "3 other Oaxaca (City) birds in the British Museum show the same characters. 2 ♀s show no color whatever." He tells me there are four males (including the type), which show the same characters. It would seem that *roseipectus* is a distinguishable race, differing from *C. m. mexicanus* in the "orange-red flush" over a large portion of the under parts, and should be recognized, at least until additional material is obtained.

In May 1936, I observed individuals of *Carpodacus mexicanus* in the patio of a house near Mitla, Oaxaca, twenty-five miles in an air line southeast of the City of Oaxaca. Lacking a gun, I was unable to collect them, but a close examination within less than ten feet, indicated an extreme suffusion of red on the under parts.

Carpodacus mexicanus griscomi new subspecies
Guerrero House Finch

Type.—Male adult, no. 22668, collection of Robert T. Moore; Amogileca (=Amojileca), Guerrero, Mexico; April 5, 1937, collected by W. W. Brown.

Subspecific characters.—Closest to *Carpodacus mexicanus mexicanus* of Mexico, but males differ in nuptial plumage in having much less buff, if any, on the flanks; ground color of posterior under parts lighter, Pale Pinkish Buff instead of Pale Pinkish Cinnamon to Clay Color; upper parts much paler gray; streaking wider; size somewhat smaller (in males wing 77.2, tail 60.2, as compared with wing 80.3, tail 63.9). In the winter plumage males are much paler above and below. Females show the same differences.

Winter plumaged specimens of both sexes of *griscomi* are slightly more buffy on the posterior under parts than birds in nuptial plumage, but *mexicanus* is much more so, and is in some cases Clay Color. Differs from *roseipectus* in lacking altogether the orange-red flush over the under parts.

Range.—Apparently all the known specimens, a very large series, have come from the vicinity of Chilpancingo and Amojileca, at 4000 feet, in the Sierra Madre del Sur of Guerrero.

Specimens examined.—Guerrero, Chilpancingo, 19 ♂♂, 4 im. ♂♂, 4 ♀♀, 2 im. ♀♀; Amojileca, 8 ♂♂, 3 ♀♀.

Griscom (1934, p. 416) has stated that specimens from Chilpancingo "do not seem to show the slightest approach to the characters claimed for the little known *roseipectus* Sharpe from Oaxaca." It is clear from van Rossem's notes that this is true.

It is not surprising to find this new race isolated in the peculiar east-west range of the Sierra Madre del Sur, which is completely detached from the main plateau of

Mexico, referred to by geologists as the Anahuac plateau (Thayer, 1916, p. 62). The range is a very ancient one, going back at least to Paleozoic time, according to Schuchert (1935, p. 140), and is entirely separated from the Sierra Madre Occidental by the volcanic province which extends in wild rugged topography from Cape Corrientes on the west coast to Jalapa, Veracruz.

AVERAGE MEASUREMENTS OF MALE HOUSE FINCHES IN MILLIMETERS

Latitude	Group	No. of specimens	Place	Name	Wing	Tail	Exposed culmen	Tarsus	W—T:Tar.
40°	C.	18	N. California	(*grinnelli*)	77.6	58.0	9.7	17.6	M = 2.0
	D.	17	Nevada	(*solitudinis*)	78.2	58.4	9.9	17.4	M = 2.4
	P.	9	N. Colorado	(*smithi*)	78.1	69.9	10.2	17.6	M = .7
34°	C.	21	San Clemente	(*clementis*)	76.5	60.0	10.5	.....	.....
	C.	27	S. California	(*grinnelli*)	77.4	58.3	10.1	17.6	M = .9
	D.	22	Arizona	(*front.* × *ruberrimus*)	77.8	59.0	10.1	17.3	M = 1.5
	P.	19	N. Mex. and S. Colo.	(*frontalis*)	77.9	59.1	10.1	17.5	M = 1.3
30°	C.	18	Guadalupe Island	(*amplus*)	80.0	61.2	12.5	19.6	M = .0
	C.	6	San Benito Island	(*mcgregori*)	78.5	58.7	11.9	18.4	M = 1.0
	C.	5	N. Lower California	(*grinnelli*)	76.1	56.8	9.8	17.9	M = 1.4
	D.	27	S. Sonora	(*ruberrimus*)	73.7	57.4	9.9	17.1	L = .8
	P.	8	SW. Texas	(*front.* × *potosinus*)	78.9	60.4	10.4	17.8	M = .7
	P.	4	Kinney Co., Texas	(*potosinus*)	78.6	60.3	10.1	17.9	M = .4
25°	C.	7	Hawaii	(*mutans*)	77.8	57.0	9.9	17.4	M = 3.4
	D.	15	S. Lower California	(*ruberrimus*)	72.8	56.7	10.3	17.3	L = 1.2
	D.	22	Sinaloa	(*rhodopnus*)	71.2	54.9	9.5	16.8	L = .6
	P.	4	San Feliz, Chi.	(*altitudinis*)	72.8	55.1	10.3	16.5	M = 1.2
	P.	17	Jalisco, Durango	(*coccineus*)	79.3	59.0	10.1	18.1	M = 2.2
	P.	17	Guanajuato	(*centralis*)	82.1	64.1	10.5	17.7	M = .3
	P.	9	San Luis Potosi	(*potosinus*)	80.3	61.7	10.1	18.0	M = .6
	P.	2	Tamaulipas	(*nigrescens*)	78.2	60.4	9.8	16.9	M = .9
18°	S.	17	Guerrero	(*griscomi*)	77.2	60.2	10.8	18.0	L = 1.0
	S.	1	Oaxaca	(*roseipectus*)	76.0	61.0	10.5	18.0	L = 2.5
	S.	11	Hidalgo, Mex. / Puebla, Mor.	(*m. mexicanus*)	80.3	63.9	10.2	18.1	L = 1.7

Groups are as follows: C. = Coastal, D. = Desert, P. = Plateau, S. = Sierra del Sur.

The last column represents difference between length of wing and tail, compared with tarsus. M = difference is more than tarsus, L = less; the figures indicate the degree to which the difference is more or less than tarsal length.

LITERATURE CITED

Bailey, F. M.
1928. Birds of New Mexico (New Mexico Department of Game and Fish), xxiv + 807 pp.

Bailey, H. H.
1906. Ornithological notes from western New Mexico and the Tres Marias and Isabella islands, Auk, vol. 23, pp. 369-391.

Beechey, F. W.
1831. Narrative of a voyage to the Pacific and Beering's Strait, to cooperate with the Polar expedition (London, Henry Colburn and Richard Bently), iv + 452 pp.

Bianchi, V.
1898. Uebersicht der palaearktischen Arten der Gattung *Carpodacus* Kaup. Jour. für Ornith., 1898, pp. 102-123.

Brewster, W.
1877. Two undescribed nests of California birds. Bull. Nutt. Orn. Club, vol. 2, pp. 37-38.
1902. Birds of the Cape region of Lower California. Bull. Mus. Comp. Zool., vol. 41, pp. 1-241.

Brooks, C. F.
1936. Climatic maps of North America (Blue Hill Meteorological Observatory, Harvard University Press), 26 maps.

Coues, E.
1865. Ornithology of a prairie-journey, and notes on the birds of Arizona. Ibis, ser. 2, vol. 1, pp. 157-165.

Cowan, I. McT.
1937. The house finch at Victoria, British Columbia. Condor, vol. 39, p. 225.

Dawson, W. L.
1923. The birds of California (Patrons' ed., San Diego [etc.], South Moulton Co.), vol. 1, xvii + 522 pp.

Figgins, J. D.
1930. Proposals relative to certain subspecific groups of Carpodacus mexicanus. Proc. Colo. Mus. Nat. Hist., vol. 9, no. 1, pp. 1-3.

Grinnell, J.
1911. The linnet of the Hawaiian Islands: a problem in speciation. Univ. Calif. Publ. Zool., vol. 7, pp. 179-195.
1912. A name for the Hawaiian linnet. Auk, vol. 29, pp. 24-25.
1915. A distributional list of the birds of California. Pac. Coast Avifauna No. 11, pp. 5-217.
1928. A distributional summation of the ornithology of Lower California. Univ. Calif. Publ. Zool., vol. 32, pp. 1-300.
1932. Type localities of birds described from California. Univ. Calif. Publ. Zool., vol. 38, pp. 243-324.

Griscom, L.
1934. The Ornithology of Guerrero, Mexico. Bull. Mus. Comp. Zool., vol. 75, pp. 367-422.

Howell, A. B.
1917. Birds of the islands off the coast of southern California. Pac. Coast Avifauna No. 12, pp. 5-127.

Kitchin, E. A.
1934. Distributional check-list of the birds of the state of Washington. Northwest Fauna Series, No. 1, 28 pp.

Lawrence, G. N.
1874. The birds of western and northwestern Mexico [etc.]. Mem. Bost. Soc. Nat. Hist., vol. 2, pp. 265-319.
1902. Notes on a small collection of birds from the Island of Maui, Hawaii. Condor, vol. 4, pp. 59-62.

McLellan, M. E.
1926. Expedition to the Revillagigedo Islands, Mexico, in 1925. VI. Proc. Calif. Acad. Sci., 4th ser., vol. 15, pp. 279-322.

Mearns, E. A.
1898. Descriptions of two new birds from the Santa Barbara Islands, southern California. Auk, vol. 15, pp. 258-264.

Michener, H., and Michener, J. R.
1931. Variation in color of male house finches. Condor, vol. 33, pp. 12-19.

Moore, R. T.
1936. Description of a new race of Carpodacus mexicanus. Condor, vol. 38, pp. 203-208.
1937a. Four new birds from northwestern Mexico. Proc. Biol. Soc. Wash., vol. 50, pp. 95-102.
1937b. A new house finch from central Mexico. Condor, vol. 39, pp. 204-206.
1938. Unusual birds and extensions of ranges in Sonora, Sinaloa and Chihuahua, Mexico. Condor, vol. 40, pp. 23-28.
1939. Two new races of *Carpodacus mexicanus*. Proc. Biol. Soc. Wash., vol. 52, pp. 105-112.

Oberholser, H. C.
1899. Piranga rubra and Carpodacus mexicanus frontalis preoccupied? Auk, vol. 16, pp. 185-186.

Phillips, J. C.
1912. The Hawaiian linnet, *Carpodacus mutans* Grinnell. Auk, vol. 29, pp. 336-338.

Ridgway, R.
1901. The birds of North and Middle America, Part 1, xxv + 715 pp.
1912. Color standards and color nomenclature (Washington, D. C., published by the author), pp. 1-43, 53 pls.

Salvin, O., and Godman, F. D.
1879-1904. Biologia Centrali-Americana. Aves., vol. 1, xliv + 512 pp.

Schuchert, C.
1935. Historical geology of the Antillean-Caribbean region (New York, John Wiley and Sons, Inc.), xxvi + 811 pp.

Sharpe, R. B.
1888. Catalogue of the Passeriformes or perching birds. Cat. Birds Brit. Mus., vol. 12, xv + 871 pp.

Stone, W.
1930. [Review of J. D. Figgins] proposals relative to certain subspecific groups of *Carpodacus mexicanus*. Auk, vol. 47, p. 590.

Tate, R. C.
1925. The house finch in the Oklahoma panhandle. Condor; vol. 27, p. 176.

Taverner, P. A.
1934. Birds of Canada. Nat. Mus. Can., Bull. 72, pp. 1-445.

Thayer, W. N.
1916. The physiography of Mexico. Jour. Geol., vol. 24, pp. 61-94.

United States Department of Agriculture.
1922. Atlas of American agriculture, Part II, Climate. Section A, precipitation and humidity, 48 pp.

United States Weather Bureau.
1932-1937. Climatic summary of the United States (U. S. Government Printing Office), 4 vols. 106 pts.

Van Rossem, A. J.
1925. The status of the San Clemente house finch. Condor, vol. 27, pp. 176-177.
1934. Critical notes on Middle American birds. Bull. Mus. Comp. Zool., vol. 77, pp. 387-490.
1936. Birds of the Charleston Mountains, Nevada. Pac. Coast Avifauna No. 24, pp. 5-65.

Vigors, N. A.
1839. Ornithology. The zoology of Captain Beechey's voyage (London, Henry G. Bohn), pp. 15-40.

Willett, G.
1933. A revised list of the birds of southwestern California. Pac. Coast Avifauna No. 21, 204 pp.

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BIRD BONES FROM ABANDONED INDIAN DWELLINGS IN ARIZONA AND UTAH

By LYNDON L. HARGRAVE

In the course of nine years of excavating in Indian sites in northeastern Arizona and southern Utah, a considerable number of bird bones has been found associated with archaeological material that dates between 700 and 1300 A.D.; material from one locality, Awatobi Pueblo, may be as recent as 1700. The bones from twenty of these sites are here recorded as indicating prehistoric distribution of bird life in the area. There is, of course, a definite association between these bones and the culture of the people who once inhabited the dwellings, a condition which in a measure alters the picture from that which a more natural accumulation would afford.

In the summary of species and sites, two other localities previously reported upon by A. H. Miller (Condor, vol. 34, 1932, pp. 138-139) are included, since the material from these sites contribute importantly to the list of species occurring in prehistoric time in the region.

Seven of the sites in the plateau region proper, where Upper Sonoran conditions prevail, are herein treated collectively, since all are now subject to similar environmental conditions. These include Poncho House in Utah; four sites in the Kayenta district—Betatakin Pueblo, Kiet Siel Pueblo, Turkey Cave and Kacody Pueblo; one on Jeditto Wash in Navajo County, Awatobi Pueblo; and Kin Tiel Pueblo, in Apache County, from which bird bones have been recorded by Miller.

The remaining fifteen sites are in the San Francisco Mountain region near Flagstaff. Although the majority of these are also in the Upper Sonoran Zone, the nearness of extensive areas of Transition flora has subjected these localities to ecological factors not found on the plateau. Two of these sites are on the south bank of the Little Colorado River at Grand Falls. Farther back from the river, along the south edge of the valley in the Wupatki National Monument, are three sites, Nalakihu Pueblo, Citadel Pueblo and Wupatki Pueblo. On the dry lower slopes of the mountains are Deadman's Cave, Terrace Pueblo (the other site reported upon by Miller) and Deadman's Fort; and, on benches of Walnut Creek are Turkey Tank, Turkey Tank Cave, Winona Village and Walnut Canyon Pueblo. In the pine forest (*Pinus ponderosa*) are three sites, Medicine Cave, Jack Smith's Tank and Baker's Bluff.

The bones from Walnut Canyon, except for one turkey bone, were collected by Ranger Paul Beaubien. All other bones herein recorded were gathered by members of the staff of the Museum of Northern Arizona. The material is catalogued and deposited in the archaeo-ornithological collection of the Museum. The collections also include several hundred skins and skeletons of modern birds taken in the region at the time the excavations were underway. This material has served as the basis of comparison for the prehistoric avifauna.

I am greatly indebted to Dr. Hildegarde Howard, of the Los Angeles Museum, who on many occasions has given me moral and material assistance in this work. Beside personally identifying species for which I had insufficient comparative material, she has a number of times verified my identifications. I also wish to express appreciation to Dr. Alexander Wetmore of the United States National Museum for identifying the parrot bones, and to the Museum of Vertebrate Zoology for the loan of comparative material. Bones identified by Dr. Howard and Dr. Wetmore are listed with their initials in parentheses.

An attempt has been made to determine the number of individual birds represented by the material, since this information will be important later in interpreting the ecology of prehistoric sites. In doing this, the manner of occurrence and the position of each bone in the site have been carefully considered. It is believed that the number of individuals given here is as accurate as circumstances permit.

Podilymbus podiceps. Pied-billed Grebe. Femur, tarsometatarsus and coracoid (HH), probably of a single individual, from Grand Falls.

Branta canadensis. Canada Goose. Femur, coracoid and ulna (HH), repesenting one individual each from Poncho House, Turkey Tank and Winona Village. The sizes of these bones indicate the race *canadensis*.

Chen hyperborea. Snow Goose. One femur from Turkey Tank Caves. White geese appear to be rare in Arizona. Three unpublished occurrences are as follows: A reliable Hopi Indian informed me that these geese were common on desert lakes of the Little Colorado River valley before 1908, and especially in 1903 or 1904 at Red Lake, lower Polacca Wash, a few miles north of Leupp. During the first half of Octobor, 1928, I saw a large flock flying low toward a small lake in White Cone Valley, Navajo County. The last record is one by Dr. Parry Reiche who told me that he saw a flock of about eighty white geese about three miles east of Red Lake Trading Post on Polacca Wash in early October a few years ago.

Nettion carolinense. Green-winged Teal. Ulna and humerus of one individual from Grand Falls and a humerus from Wupatki Pueblo (HH).

Cathartes aura. Turkey Vulture. An ulna from Awatobi Pueblo (HH).

Accipiter velox. Sharp-shinned Hawk. Femur, ulna and tibiotarsus, representing one individual each from Kiet Siel, Grand Falls, and Winona Village.

Buteo borealis. Red-tailed Hawk. A humerus from Awatobi Pueblo (HH).

Buteo regalis. Ferruginous Rough-leg Hawk. An ulna from Wupatki Pueblo (HH).

Aquila chrysaëtos. Golden Eagle. A scapula (HH), carpometacarpus, 2 tarsometatarsi, and 2 pedal phalanges representing six individuals from four sites: Awatobi Pueblo 2, Turkey Tank Cave 2, Nalakihu 1, and Wupatki Pueblo 1.

Haliaëtus leucocephalus. Bald Eagle. An ungual phalanx from Wupatki Pueblo (HH). Although this eagle is occasionally seen at lakes in the San Francisco Mountains, I know of no record as far east as the valley of the Little Colorado River.

Circus hudsonius. Marsh Hawk. An ulna from Wupatki Pueblo (HH).

Falco sparverius. Sparrow Hawk. Coracoid, carpometacarpus, 2 ulnae, 3 humeri, 2 tarsometatarsi and a femur representing eight individuals from three sites: Turkey Tank 1, Winona Village 5, and Wupatki Pueblo 2. Miller (*op. cit.*) has commented upon the small size of sparrow hawk bones, particularly the skull, ulnae and carpometacarpi from Terrace Pueblo. The carpometacarpus from Winona Village is identical in length (24.7 mm.) to one from Terrace Pueblo. The smallest mature historic specimen (a September male, Z8.713) of this element of *F. s. phalaena* in the Museum of Northern Arizona collections is 27.4 mm., a size 0.9 mm. less than that given by Miller for "seemingly an average-sized male" (Mus. Vert. Zool. no. 15548). All prehistoric carpometacarpi of this species yet recovered from northern Arizona are close in size to the carpometacarpi of *F. s. peninsularis*, as first noticed by Miller.

Dr. Miller did not give measurements for other elements, but indications are that the same small size shown by the carpometacarpi characterizes the other elements as well. This particularly is true of the ulnae. Miller reported upon five ulnae. These show a range (measurements taken by me) from 42.9 to 46.3 mm. Bones of *F. s. phalaena* taken in the San Francisco Mountains in very recent time give a range of 46.7 mm. to 47.2 mm. The additional two prehistoric bones recorded herein average larger, 47.0 and 50.3 mm., respectively (the tip of the olecranon of the latter, AO.161, is very slightly chipped). There is an overlap in the size ranges of the tarsometatarsi, also.

Callipepla squamata. Scaled Quail. Five humeri, a carpometacarpus (HH) and a femur, of six individuals from four sites: Winona Village, Deadman's Fort, Terrace Pueblo and Wupatki Pueblo. The range of this species in Arizona during historic time seems to be restricted to the southeastern portion of the state (grassy parts of the Sonoran zones south of the Mogollon plateau and mostly

south of the Gila River valley). Between this and the localities of archaeological occurrences given herein, lies the heavily forested Mogollon Rim and San Francisco Mountain, a probable natural barrier for the distribution of this species. Reference to the occurrence of *Callipepla* in New Mexico, as given by Bailey (Birds of New Mexico, 1928, map 5 and pp. 215-216), however, shows that the Scaled Quail approaches the Arizona line west of Wingate. There is a strip of pure Upper Sonoran flora that passes from Wingate down the Little Colorado River valley to the Grand Canyon. These archaeological occurrences are within this strip. The retreat or extirpation of this species from the east and north slopes of San Francisco Mountain must have occurred between 1150 A.D., a date when Wupatki Pueblo is known to have been occupied, and 1880 A.D., when the country became settled.

It is to be noted, however, that the Scaled Quail may be found in this region today, owing to the fact that on March 13, 1934, I released 22 banded and 2 unbanded Scaled Quail for the State Game Department, at Heiser Spring, about 2 miles from Wupatki Pueblo.

Meleagris gallopavo. Turkey. There are 230 bones representing 101 individuals from twelve sites: Poncho House 4, Betatakin Pueblo 1, Kiet Siel Pueblo 77, Turkey Cave 3, Kacody Pueblo 7, Awatobi Pueblo 1, Grand Falls 2, Walnut Canyon 2, Winona Village 1, Wupatki Pueblo 1, Baker's Bluff 1, Medicine Cave 1. A number of specimens included herein could be determined correctly only as *Meleagris,* but the large number of bones having species characters would seem to justify the assignment of all turkey bones to *M. gallopavo,* especially as no other species of *Meleagris* is known from the area.

Those sites from which came the greatest number of individuals are located in areas where historically the wild turkey is not known. Archaeological data, I believe, are sufficiently convincing to permit the statement that the turkey was under domestication by the people who occupied the Kayenta district area between 1272 and 1300 A.D. Of all the bones taken at Kiet Siel Pueblo those of the turkey are apparently most abundant. In sites in or near San Francisco Mountain where turkeys are still common, turkey bones are no more abundant than the bones of many other species of birds recovered. I do not believe the turkey was domesticated in this area.

Grus canadensis. Crane. Coracoid, ulna and radius (HH) of three individuals from two sites; Turkey Tank 1, and Wupatki Pueblo 2. I do not know of the occurrence of cranes in the immediate vicinity of these archaeological finds in historic time.

Fulica americana. Coot. A tarsometatarsus from Wupatki Pueblo.

Zenaidura macroura. Mourning Dove. A sternum, 2 carpometacarpi, 2 coracoids, 2 humeri, 1 ulna, and 1 tibiotarsus of seven individuals from three sites: Turkey Tank Caves 1, Winona Village 4, Wupatki Pueblo 2.

Rhynchopsitta pachyrhyncha. Thick-billed Parrot. One nearly complete skeleton (AW), and a sternum, coracoid and tibiotarsus of three other individuals. These four parrots came from Wupatki Pueblo.

Although this parrot is known from southern Arizona in late historic time (Vorhies, Condor, vol. 36, 1934, p. 180; Wetmore, Condor, vol. 37, 1935, p. 18) its occurrence in northern Arizona is indicated as early as 1583 (Wetmore, Condor, vol. 33, 1931, p. 35). That the Thick-billed Parrot was native so far north as San Francisco Mountain prior to 1250 A.D., however, is not necessarily established by these archaeological occurrences, since bones of the Red-blue-and-yellow Macaw (*Ara macao,* identified by A. W.), obviously a trade product, also have been found at Wupatki Pueblo. Even today macaws are valued by the Pueblo Indians for their colorful feathers. *Rhynchopsitta* may or may not at one time have been indigenous to the pine forests of San Francisco Mountain, but the presence of *Ara* can be explained satisfactorily only through human agencies.

Bubo virginianus. Horned Owl. Nearly complete skeletons of two individuals, one from Grand Falls and one from Nalakihu Pueblo; and 2 coracoids, 1 humerus, 1 tarsometatarsus and 1 tibiotarsus of three other individuals from Poncho House (1), Awatobi Pueblo (1), and Deadman's Cave (1).

Asio wilsonianus. Long-eared Owl. One nearly complete skeleton from Nalakihu Pueblo; and a humerus, ulna, femur, tarsometatarsus and carpometacarpus representing two individuals, one from Wupatki Pueblo and one from Jack Smith's Tank.

Asio flammeus. Short-eared Owl. One humerus from Nalakihu Pueblo (HH). This species has not been recorded from the San Francisco Mountain region in historic times.

Cryptoglaux acadica. Saw-whet Owl. A feathered foot with part of a tarsus from Kiet Siel Pueblo (a cave deposit). I know of but two other occurrences of this species from northern Arizona, one

from San Francisco Mountain recorded by Mearns (Auk, vol. 7, 1890, p. 54) and another from the same mountain, found dead by Randolph Jenks on August 11, 1934. This latter specimen is number Z8.540 in the Museum of Northern Arizona Collection.

Chordeiles minor. Nighthawk. An ulna from Deadman's Cave.

Colaptes cafer. Red-shafted Flicker. One incomplete, dessicated body from Betatakin Pueblo (a cave site), and an ulna and radius of one individual from Winona Village.

Cyanocitta stelleri. Crested Jay. A humerus from Kiet Siel Pueblo.

Corvus corax. American Raven. A carpometacarpus, ulna, radius, and wing phalanx of one individual; coracoid, 2 ulnae, radius, femur, tibiotarsus and tarsometatarsus of another; one nearly complete skeleton; and a single mandible, 2 humeri, 4 ulnae, 1 radius, 1 carpometacarpus, 1 femur, 2 tarsometatarsi and 1 pedal phalanx, each bone representing an individual bird. Total of 117 bones of 16 individuals from 8 sites: Betatakin Pueblo 1, Kiet Siel Pueblo 2, Awatobi Pueblo 3, Walnut Canyon Pueblo 1, Winona Village 2, Citadel Pueblo 1, Nalakihu Pueblo 2, and Wupatki Pueblo 4.

Corvus brachyrhynchos. Crow. One humerus from Walnut Canyon Pueblo.

Cyanocephalus cyanocephalus. Pinyon Jay. A carpometacarpus of one individual and a humerus of another, both from Winona Village.

Nucifraga columbiana. Nutcracker. Lower mandible and premaxillary from Wupatki Pueblo.

Lanius ludovicianus. Loggerhead Shrike. One humerus from Wupatki Pueblo.

SUMMARY

The new material treated herein consists of 599 complete or broken bird bones of 186 individuals and 30 species. These bones are from prehistoric human habitations in northeastern Arizona and southeastern Utah. The area in which these sites occur is divided into two major ecological regions, the plateau region and the San Francisco Mountain region.

The following list summarizes the prehistoric material from these two regions.

Species	Plateau region	San Francisco Mountain region
Podilymbus podiceps	....	1
Branta canadensis	1	2
Chen hyperborea	....	1
Nettion carolinense	....	2
Cathartes aura	1	....
Accipiter velox	1	2
Buteo borealis	1	1
Buteo regalis	....	1
Aquila chrysaëtos	2	4
Haliaëtus leucocephalus	....	1
Circus hudsonius	....	1
Falco mexicanus	....	1
Falco sparverius	1	10
Lophortyx gambeli	....	3
Callipepla squamata	....	7
Meleagris gallopavo	96	8
Grus canadensis	....	3
Fulica americana	....	2
Zenaidura macroura	....	7
Rhynchopsitta pachyrhyncha	....	4
Bubo virginianus	2	4
Otus asio	....	1
Asio wilsonianus	....	3
Asio flammeus	....	1
Cryptoglaux acadica	1	....
Chordeiles minor	....	1
Colaptes cafer	1	2
Cyanocitta stelleri	1	....
Pica pica	....	1
Corvus corax	6	10
Corvus brachyrhynchos	....	1
Cyanocephalus cyanocephalus	....	2
Nucifraga columbiana	....	1
Turdus migratorius	....	1
Lanius ludovicianus	....	1

All species represented by bones from the plateau region are known there today with the exception of the Saw-whet Owl and the turkey. It is believed that the turkey was a domestic bird. Such a supposition would logically account for the large number of individuals from this region.

The situation in the San Francisco Mountain region is different. Of the species reported from dwellings in this area there are seven that are not known to occur naturally there today. These are: *Callipepla squamata, Lophortyx gambeli, Grus canadensis, Rhynchopsitta pachyrhyncha, Asio flammeus, Otus asio* and *Pica pica*. Four others, *Chen hyperborea, Falco mexicanus, Asio wilsonianus* and *Cryptoglaux acadica,* are of rare occurrence; and five, *Podilymbus podiceps, Branta canadensis, Nettion carolinense, Haliaëtus leucocephalus* and *Fulica americana,* are not now found in the vicinity of the sites from which the material came. Only 19 of the 35 species from these sites are now of common occurrence, a surprisingly small number. Obviously the ecology at some of these sites has changed considerably since they were occupied by Indians, but to what extent cannot be determined until more material has been gathered and identified. There is sufficient data, however, to indicate that a change in conditions may have been a cause for the abandonment of the area by the human inhabitants of these sites.

Museum of Northern Arizona, Flagstaff, Arizona, January 5, 1939.

ANALYSIS OF SOME HYBRID POPULATIONS OF JUNCOS

By ALDEN H. MILLER

Our progress toward understanding the mode of origin of races and species of animals depends on the success of bringing together the sciences of genetics and natural history. The geneticist must come to appreciate the factors governing distribution, survival, and isolation in wild populations. The naturalist and student of geographic variation must clearly see the genetic picture. We are not without examples of distinctly successful attempts at this synthesis of fields. I think of F. B. Sumner's analysis of a concrete case of intergradation of geographic races of *Peromyscus* and of Dobzhansky's comprehensive treatment of the problem of "Genetics and the origin of species." The latter work is most illuminating, for it is made clear that the wealth of knowledge about inheritance in the fruit fly, *Drosophila*, can be applied to geographic races and wild populations of fruit flies in order to get at the very heart of the method of race origin.

Ornithology has been at the forefront in advancing our knowledge of geographic variation. Can it go farther than it has already by utilizing the genetic approach? Not many wild birds that are geographically variable lend themselves to experimental breeding on a scale that will permit adequate genetic treatment. The outlook is not hopeless, but it is not good. I am of the belief, however, that we can contribute significantly by adopting the geneticist's viewpoints in analyzing intergrades and naturally occurring hybrids, even when we are limited in the extent to which this analysis may be supported by experimental breeding.

In working upon the genus *Junco*, it became apparent to me that some rather favorable conditions existed for studying natural hybrid populations. The very hybrid complexes which Dwight (Bull. Am. Mus. Nat. Hist., vol. 38, 1918, pp. 269-309) earlier thrust into the background as without significance taxonomically prove to be the most important groups from the standpoint of biologic theory. We may consider some of the general aspects of the work on these hybrids without presenting much of the technical detail at this time.

The Gray-headed Junco, *Junco caniceps caniceps*, of the central Rocky Mountain area, through a combination of factors has proved to be the best subject for special study within the genus. Its breeding range is isolated almost completely by unfavorable desert or plains regions, but on small separated mountain areas around the periphery of its general range are small breeding populations that clearly result from hybridization of *caniceps* with other kinds of juncos. These surrounding kinds happen to be either moderately or very well differentiated from *caniceps*, and the hybrid populations are as a result interesting assortments of individuals. On the north, *caniceps* meets the Pink-sided Junco (*mearnsi*) in the northern, somewhat isolated section of the Wasatch Mountains, and in scattered ranges in southern Wyoming. On the west are hybrids with Oregon Juncos (*J. o. thurberi*) in well isolated mountain tops in southern Nevada and southeastern California. In the south are hybrid groups between *caniceps* and the Red-backed Junco (*J. o. dorsalis*), best known from the Kaibab region north of the Grand Canyon in Arizona, but also from certain mountains in northern New Mexico.

These Gray-headed Juncos apparently have no inhibitions in accepting a member of another race or "species" as a mate. While in the field in northern Utah, I became impressed with the random mating of *caniceps* and *mearnsi*. Mixed pairs were taken with young. There seems to be nothing to prevent the complete interpenetration of *caniceps* and *mearnsi* except partial geographic barriers consisting of ecologically un-

suited regions. It is difficult to imagine a special survival value in the pink sides of *mearnsi* or in the red back of *caniceps* related to the particular environments. There may be physiological features of the two forms that differ, however. Striking also, is the fact that the distinct types, *J. c. dorsalis* and *J. o. pinosus* have been hybridized in captivity.

From an analysis of hybrid groups we may learn something about the association of characters in the organism. Take, for example, wing and tail length. These two dimensions are correlated within all populations of juncos. It might be claimed that their variation is not genetic and that their correlation is due to the immediate impress of the environment on the growth of all the major flight feathers. However, when two strikingly different forms hybridize, whose differences even in dimensions most certainly must in part be genetic, there is shown the same correlation of wing and tail. We must conclude that there are some common genetic factors that control these parts. In view of this evidence, it is understandable why wing and tail have more or less kept pace in the evolution within the genus. They are likely to continue to do so, for if selection pressure favors long wing, it will favor the continuance of factors in the germ line that determine long tail as well.

In hybrid juncos we find that most dimensions and also the intensity of blackish pigment of the hood blend from one extreme to the other. We may be permitted to assume from the extensive experimental analyses of this sort of phenomenon in other organisms, that there are many genetic factors responsible for these characters. The hybrid populations of southern Nevada and northern Arizona average somewhere between the averages for the parental types concerned in each case. They do not show increased variability, but that is exactly the situation we now know to expect in the F_2 generation in multiple factor inheritance where the number of factors is quite large. The samples of twenty to forty birds are not large enough to reveal F_2 segregation.

We may use these blending characters to determine the proportion to which the two parental types contributed to a given population in a small isolated intervening region. For example, on the Charleston Mountains of southern Nevada this evidence suggests that *caniceps* parentage was somewhat greater than *thurberi* parentage. But on the Kaibab plateau *caniceps* and *dorsalis* seem to have contributed equally to the ancestry of the local group. Probably each is still contributing in some measure through the movement of typical individuals into this area.

With this as a background, other characters may be studied which seem to rest on smaller numbers of genetic factors. Between both *thurberi* and *caniceps*, and *mearnsi* and *caniceps* there are distinct differences in the color of the back area. *Caniceps* has a single pigment, a reddish phaeomelanin, that gives the rich mahogany red back. In *thurberi* there is a yellowish phaeomelanin in the bases of the barbules and a dusky eumelanin on the tips of the barbules in a proportion that produces a tan-colored back. *Mearnsi* is similar to *thurberi*, but the yellow phaeomelanin is of slight amount and the tips of eumelanin are extensive. The result is a drab brown back.

In crosses of these forms it is clear that the eumelanin and phaeomelanin pigments are inherited more or less independently. The phaeomelanins, the red and yellow pigments, do not show intermediacy in the crosses; the pigment clearly is one or the other. In the *thurberi-caniceps* hybrids the red apparently is dominant to yellow. In the Charleston Mountain group, the preponderance of red over yellow is far out of proportion to that expected on the basis of evidence of parentage derived from the blending characters. The one experimental hybrid in which the same characters are involved is red-backed (F_1 generation).

The eumelanin in hybrids either is present in full amount, absent on the outer vanes of many of the feathers, or absent entirely. There results from the independent assortment of these pigments some types of back coloration unlike either parent. Most striking is one that is a clear light yellow, owing to yellow phaeomelanin (*thurberi*) and complete absence of eumelanin (*caniceps*).

In some of the mountains in California that lie east of the Sierra Nevada are *thurberi*-like populations, that have had some mixture with *caniceps*. Perhaps some of the Charleston Mountain hybrids have crossed with typical *thurberi* here. On one small mountain top in the Panamint range, the yellow-backed birds are so prominent in the population as to suggest a "new form" of junco. Were it not for our knowledge of the inheritance of the characters concerned, these yellow-backed birds would be very puzzling. Actually we have here a situation that might lead to a new race. All that is needed is a little better isolation and greater homogeneity. Suppose that through fluctuation in population the colony on this small isolated range was rebuilt from homozygous yellow-backed types, or that through inbreeding the other variants were eliminated, a striking insular form would be established. The Panamint hybrid group is one that missed by a narrow margin being a well-characterized natural race. It still has a chance.

In the *caniceps-mearnsi* hybrids, the *mearnsi* yellow pigment is dominant over the red of *caniceps*, the reverse of the situation in *caniceps* and *thurberi*. The eumelanin behaves in the same way.

The sides of *caniceps* are pale gray in contrast to the yellowish and cinnamon pink of *thurberi* and *mearnsi*, respectively. The gray is a eumelanin, the yellow and pinks, phaeomelanin, all rather dilute. In crosses, these pigments do not mix. There is no intermediate pigment and rarely are the two pigments in the same part of a feather. But, some feathers may be gray on part of the web and pink elsewhere, and in the side area totally gray feathers may be mixed with pink feathers. In the *thurberi-caniceps* hybrids the *thruberi* character is more apparent in females than in males. It appears that there is some interaction with sex factors. In most species of the genus females are more given to developing phaeomelanins than are males. The *mearnsi* type of side seems to be dominant over that of *caniceps* in both sexes.

Interesting evidence of interaction of factors is seen in a hybrid from the White Mountains of east-central California. This bird lacks all phaeomelanin of the sides and hence is gray. The head is quite dark, approaching average *thurberi*. The gray sides, which are produced by eumelanin, as is the head, are darker gray than in any *caniceps*. Apparently there are factors present that determine eumelanin as the side pigment. But the intensification factors for the head, that cause it to be black, also intensify the side area. The bird is a curious-appearing individual. Its dark gray head and sides make it appear like a Slate-colored Junco, but it has a sharply defined yellowish back patch.

One character in the *caniceps-dorsalis* hybrids is worth noting especially. The two forms differ most importantly in the color of the upper mandible, one (*dorsalis*) being black, the other white. Undoubtedly a number of genetic factors is involved, if we may judge from the several intermediate stages that appear among the Kaibab hybrids. It is clear also that the parent races are not entirely homozygous. No completely black bill has ever been found in *caniceps*, nor completely white bill in *dorsalis*. But at least some of the factors occur in the populations of both races and are widely diffused through them. The races differ in the average occurrence of certain genes for bill color and in the presence or absence of others that would lead to extreme manifestations. This is indeed the concept of races to which the genetic approach seems to lead us.

Hidden in the total germ plasm of every race are factors which either because of scarcity, recessiveness or lethal phenomena seldom result in outward expression. Some of these may be residual from ancestral forms or result from intermixture of diverse forms. Others may have come about as new mutations, perhaps repeatedly in different areas, and may have spread to some degree in the populations. Such characters would seem to be the white-wing bars which appear sporadically in a number of kinds of juncos and the mahogany red pileum that is present in 6 per cent of all *caniceps* populations. A feature like red pileum might sometime come to predominate and to characterize a race, as indeed the white-wing bars do characterize, imperfectly, the species *aikeni*.

In conclusion, it is felt that the analysis of hybrid populations has emphasized the possibility of independent evolution of most color characters in the genus *Junco*. It has pointed strongly to the heritability of many racial differences. The necessity of spatial or ecologic isolation in preventing swamping of races has been emphasized. Through such a study we gain a picture of the genetic make-up of races to which we must continually refer in formulating our concepts of the operation of selection and of the mode of segregation of new race units.

Museum of Vertebrate Zoology, Berkeley, California, October 5, 1938.

FROM FIELD AND STUDY

Western Red-tailed Hawk Nests on High Voltage Tower.—On March 11, 1939, Mr. J. D. Graham, of Benicia, and I were endeavoring to locate the nest of a pair of Golden Eagles which we had seen several times a few miles north of Benicia, California. Upon inquiring of a rancher we were told that a pair of eagles had a freshly built nest in the tower of an electric power line two or three miles back in the hills. He said that his son had very foolishly risked climbing to it a week before and that the boy had reported there were no eggs at that time.

We drove as far as we could by car, walked about two miles farther, and located a nest which we concluded must be the one to which the rancher had referred. However, it was not an eagle's nest, but that of a Western Red-tailed Hawk (*Buteo borealis calurus*). A pair of red-tails was in the air about the nest, circling at times in company with three other individuals of the same species which appeared on the scene from an adjacent canyon. The location was six miles north of Benicia in Sulphur Springs Valley, about a hundred yards from a small creek of the same name. The height of the steel tower (fig. 38) was computed to be eighty feet, and we fixed the height of the nest at seventy-five feet from the ground.

On March 27, in company with Mr. Gunnar Larson, of Berkeley, I again visited the location. A red-tail was perched near the top of the adjacent tower to the north, and while I was taking photographs of the site, it sailed above and screamed. A notice at the bottom of the tower warned that, "These towers carry high voltage electric wires. It is dangerous to climb them." We decided to heed the warning and to forego closer inspection of the nest.—EMERSON A. STONER, *Benicia, California, April 20, 1939.*

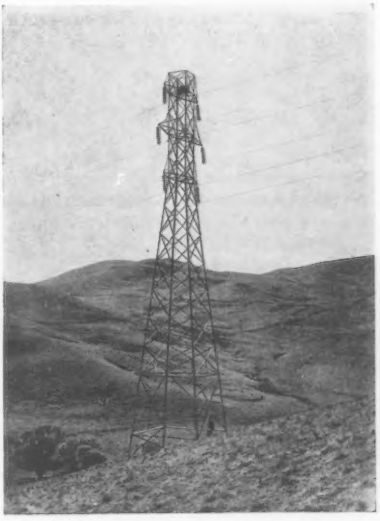

Fig. 38. Nest of Western Red-tailed Hawk on steel tower near Benicia, California.

Fork-tailed Petrels from the Coast of San Diego County, California.—Grinnell and Test (Condor, vol. 41, 1939, pp. 170-172) recently revived the name *plumbea* for the southern form of the Fork-tailed Petrel (*Oceanodroma furcata*) and gave descriptions of the southern and northern races and a table of measurements. Thus has been provided the basis for determining the identity of two petrels of this species, taken at the extreme southern coastal end of its range, which are in the collection of the San Diego Society of Natural History.

One of these birds proves to be a typical specimen of the southern race. It was recently sent in the flesh to the San Diego Natural History Museum by J. F. Hagerty. He had found it lying, in an exhausted condition, beside the coast highway at Cardiff, San Diego County, on June 9, 1939. The situation would suggest that the bird had been struck at night by an automobile, but in preparing the specimen the writer found neither broken bones nor abrasion of any sort. The bird was in very poor physical condition, either through sickness or lack of food, but was in good plumage. The body feathers, tail coverts and tertials appeared to have been recently molted; only the wing coverts and flight feathers showed the effects of a season's wear. This specimen is no. 18075, S.D.S.N.H.

The other bird (S.D.S.N.H. no. 2031) has been previously recorded (Stephens, Condor, vol. 21, 1919, p. 87; Willett, Pac. Coast Avifauna No. 21, 1933, p. 16) as *O. furcata*. It was found dead on the beach near San Diego on December 23, 1918.

The measurements of these two birds, both of which are females, are as follows:

	Wing	Tail	Tarsus	Middle toe without claw	Culmen
June bird	145.0	77.8	24.3	24.0	14.0
December bird	150.0	82.2	26.2	24.7	13.7

Comparing these measurements with the table made by Grinnell and Test, it is seen that the June bird falls in the range of measurements given for the southern race, *plumbea*. It also is of the darker, more plumbeous type, matching the color description given of *plumbea*.

The December bird is larger, though not large enough to be called *O. f. furcata*. It fits well into the intermediate classification exemplified by birds from Sitka. This bird is lighter in color, yet not light enough for the northern race, and must still be called *plumbea*.

Dates of capture of the two San Diego birds may bring out an interesting point. Are we to infer that the Fork-tailed Petrels that breed in the southern section of their nesting area (coast of northern California, Oregon and Washington) may be expected at this southernmost end of their known coastal range in summer, whereas the intermediate bird from Alaska represents the winter visitors in the same section? Only time and additional specimens will throw definite light on such questions as to the wanderings of these ocean waifs.—LAURENCE M. HUEY, *San Diego Society of Natural History, Balboa Park, San Diego, California, July 21, 1939.*

The Piping Plover in Colorado.—We wish to report a Piping Plover (*Charadrius melodus*), no. 20066, ♀, Colo. Mus. Nat. Hist., taken May 6, 1939, at Barr, Adams County, Colorado. This plover has been recorded (Dawson, Wilson Bull., 1899, p. 49) once before from Colorado, but on rather questionable evidence. A specimen was said to have been killed near Julesburg, Sedgswick County, Colorado, in May, 1899, but the bird was not saved. Sclater (1912) did not include this record in his book, "A History of the Birds of Colorado." Consequently, this recently collected specimen adds another interesting species to the list of Colorado birds.—ALFRED M. BAILEY and ROBERT J. NIEDRACH, *The Colorado Museum of Natural History, Denver, Colorado, May 19, 1939.*

Another Record of the Rose-breasted Grosbeak in California.—On April 23, 1939, Mr. Vincent Yoder and I discovered an adult male Rose-breasted Grosbeak (*Hedymeles ludovicianus*) feeding in the branches of a live oak tree in Scholl Canyon, near Glendale, California. We were fortunate in seeing the bird at very close range with nine power binoculars, and we were able accurately to note all points of identification in the course of the fifteen minutes that the bird remained in the tree.

There are a few other recorded occurrences of the Rose-breasted Grosbeak in California. C. H. Gilbert took several specimens of this species in Humboldt County, July 1, 1897 (McLain, Auk, vol. 15, 1898, p. 190); an immature male was taken by M. F. Gilman at Palm Springs, Riverside County, September 10, 1897 (Grinnell, Pac. Coast Avifauna No. 3, 1902, p. 59); Grinnell (Condor, vol. 33, 1931, pp. 254-255) records one taken at Quincy, Plumas County, August 5, 1891; and Carter (Condor, vol. 39, 1937, p. 217) reports one at Twentynine Palms, San Bernardino County, May 13, 1934.—WILLIAM G. WEBB, *Eagle Rock, California, June 7, 1939.*

Galapagos Shearwaters Killed by Man-o'-war Birds.—While collecting in the Galapagos Archipelago for the Academy of Natural Sciences of Philadelphia, in February of 1937, the following observations of man-o'-war birds and shearwaters were made at Tower Island.

On the morning of February 18, 1937, while at anchor close to the beach in Darwin Bay, violent squalls and torrential rains raged intermittently. The nearness of our schooner to the beach and the stormy weather seemed to cause the greater part of the large colony of Ridgway Man-o'-war Birds (*Fregata minor ridgwayi*) and Red-footed Boobies (*Sula sula*), which were nesting in the low bushes at the head of the bay, to mill about in the lee of our boat.

Numerous Galapagos Shearwaters (*Puffinus lherminieri subalaris*) were skimming about and plunging into the roughened water at this time. When a shearwater dove near the soaring man-o'-war birds, several of the latter dropped near the surface of the water and seized it when it reappeared at the surface. The struggling shearwater was carried some twenty feet in the air and then tossed from one man-o'-war to another. After a few minutes it was dropped to the water from where it was immediately retrieved, fluttering feebly, and again tossed about in the air until it appeared nearly dead. At the end of about ten minutes of "playing" with the shearwater, it was again dropped into the water. Thereupon a number of other man-o'-wars which had not taken any part in the preceding fray swooped down at the apparently lifeless form floating on the surface, but they made no attempt to seize it.

At least four shearwarters were thus beaten to death within an hour, after which the gales diminished and we left for other parts of the island.

In the course of other observations on man-o'-war birds, in various places in the Galapagos Islands and eastern Polynesia, the bullying of boobies and terns frequently was seen, but in no instance were there attacks so severe as those noted on the shearwaters at Tower Island.—RONALD W. SMITH, *Museum of Vertebrate Zoology, University of California, Berkeley, California, July 10, 1939.*

American Knots on San Diego Bay, California.—During March, 1939, Colonel Richard Meinertzhagen, eminent English ornithologist, was a visitor in San Diego where he collected a number of birds. He was making a particular study of mallophaga, in cooperation with Miss Theresa Clay of the British Museum. Among the birds taken were several American Knots (*Calidris canutus rufus*), two of which, both females, he donated to the San Diego Society of Natural History. One (no. 18053, S.D.S.N.H.), taken on March 3, shows the first suggestion of breeding plumage on breast and back; the other (no. 18056, S.D.S.N.H.), taken on March 5, is in typical winter plumage. The birds were shot near the south end of San Diego Bay, where Colonel Meinertzhagen declared that there were "hundreds" of them, adding that the Knot is a species with which he is very familiar in the Old World. This estimate was supported by J. Elton Green, of the San Diego Society of Natural History, who was acting as field assistant. The twenty-eight Knots recorded from San Diego Bay by Huey (Condor, vol. 40, 1938, p. 90) and the occurrences reported here lead one to question whether the Knot may not be more abundant than is generally supposed; it possibly is overlooked on account of its resemblance to certain other shore birds.—CLINTON G. ABBOTT, *San Diego Society of Natural History, Balboa Park, San Diego, California, July 21, 1939.*

Great-tailed Grackle Breeding in New Mexico.—On May 5, 1939, while motoring southward along the Rio Grande with my wife and Mr. Edward Chalif, I was surprised to see several Great-tailed Grackles (*Cassidix mexicanus mexicanus*) at a point about ten miles south of Albuquerque in the central part of the state of New Mexico; both males and females were present and apparently were breeding.

We saw grackles at several other points along the river farther down on our way to Las Cruces. Our casual observations seemed to indicate that they were fairly well distributed in suitable places along the river. We were surprised to see so many individuals at so many scattered points, but were even more surprised the following day, May 6, when we saw several more in the city of Lordsburg in the southwesternmost part of the state. On investigation, we found that they had actually been nesting; a dozen or more unoccupied nests were observed in the wind-swept cottonwood trees near the railroad yards. One young bird just out of the nest was seen.

Upon inquiring about the grackles, we learned from a machinist in the train yard that the birds had put in their appearance in considerable numbers four years before and had been there ever since. He said that most of the young had left the nests about a week before our arrival. Lordsburg is very near the Arizona line and a considerable distance from any large body of water.

In as much as Mrs. Bailey (Birds of New Mexico, 1928, pp. 658-659) gives comparatively few records of this species for the state of New Mexico, and only two nesting records (a colony in the southeastern part of the state on the Pecos River and one pair at La Mesa) it would seem that this bird must be extending its range. We looked for Great-tails in southeastern Arizona but did not see any. The fourth edition of the A.O.U. Check-list (1931, p. 308) does not include New Mexico in the range of this species.—ROGER T. PETERSON, *National Association of Audubon Societies, New York City, July 20, 1939.*

Further Notes on the Feeding Habits of the Treganza Blue Heron.—In a previous issue of the Condor (vol. 40, 1938, p. 258) I reported seeing Treganza Blue Herons (*Ardea herodias treganzai*) feeding on the numerous rodents trapped by the rising waters of Lake Mead, Clark County, Nevada. That observation brought letters from interested readers requesting me to watch during the rise of the lake in subsequent seasons to see if similar incidents occurred.

In the spring and early summer of 1939 I again observed blue herons carrying on rodent catching activities along the lake. They were especially active in the Muddy River valley on the Virgin arm of Lake Mead. This year several American Egrets (*Casmerodius albus egretta*) also were regularly seen in the same locality. Whether or not these white herons were actually catching rodents could not be determined, but their presence throughout the time the lake was rising leads me to suspect that such was the case.—RUSSELL K. GRATER, *Boulder Dam National Recreational Area, Nevada, August 2, 1939.*

Townsend Solitaires Declare Ownership.—On January 10, 1937, I saw a Townsend Solitaire (*Myadestes townsendi*) rout a flock of about twenty-five Bohemian Waxwings (*Bombycilla garrula*) from his haw thicket in City Creek Canyon, Salt Lake City, Utah. While on my way up the canyon, I had noted the solitaire. Just as I returned, the waxwings arrived. The solitaire dashed from one to another, moving them from place to place. They finally bunched on the top of an adjacent oak clump and raised their heads and trilled. But, this did not dismay him. He charged at the flock and put them to flight down the canyon.

On January 9, 1938, I again found the waxwings near the same place, but in this instance they were sunning themselves in tall cottonwoods along the creek and frequently descended to drink. While watching them, three of the birds flew to a nearby haw thicket. Almost instantly a solitaire came flying down the hill, but, seeing me, lit some fifty feet from where the waxwings were feeding and in no position to see them. I expected the solitaire to chase them out again, but either from fear of me or because he could not see the feeding waxwings, he came no closer.

On February 6, 1939, I noticed another instance of ownership in a downtown district where a solitaire scolded a flock of fifteen Bohemian Waxwings that had come to his pyracantha bushes. A janitor came to his service by throwing a snowball at the flock in an effort to save the berries. However, the next time I passed, the bushes were bare.—C. W. LOCKERBIE, *Salt Lake City, Utah, April 15, 1939.*

The Baird Sandpiper in Central California.—To date, so far as known, there are only two records for the Baird Sandpiper (*Pisobia bairdii*) in central California (see Mailliard, Auk, vol. 15, 1898, p. 51, and Martin, Condor, vol. 41, 1939, p. 125). The species has been observed and collected a number of times from the Santa Barbara region and southward, and Davis (Condor, vol. 41, 1939, p. 124) lists a number of occurrences in the Humboldt Bay area.

It seems worthwhile, therefore, to make mention of seven additional specimens from central California in the collection of the California Academy of Sciences. Four of these were secured by E. W. Gifford at Carmel, Monterey County, in 1911. Two of these, a male and a female, were taken on August 23, and the other two, both females, on September 1 and 4, respectively. On August 10, 1938, the writer observed seven sandpipers of this species in the course of the afternoon on the beach immediately south of the mouth of Waddell Creek, Santa Cruz County. Three of these were secured, one a male weighing 37.7 grams and the other two females, weighing 48.2 grams and 53.7 grams.—ROBERT T. ORR, *California Academy of Sciences, San Francisco, California, June 30, 1939.*

A New Bird for the Texas List.—Included in a lot of specimens recently submitted to Dr. H. C. Oberholser for determination was a Winter Wren collected on January 8, 1939, by W. A. Mayer, twenty miles east of Dallas, Texas. Dr. Oberholser on returning the specimen has informed me that it represents the southern Allegheny form, *Nannus troglodytes pullus*, and, as such, constitutes an addition to the known avifauna of Texas. The specimen in question, a male, is number 533, Dallas Museum of Natural History.—F. W. MILLER, *Dallas Museum of Natural History, Dallas, Texas, June 8, 1939.*

Birds of the Alpine Zone of Mount Shasta, California.—C. Hart Merriam in 1899 (N. Amer. Fauna No. 16) reported the results of a biological survey of Mount Shasta which was carried on by his party in the summer and early fall of 1898. This report has merited a prominent place in our literature on zonal distribution in the West. Complete and accurate as Merriam's survey has proved to be, questions inevitably are left concerning the status and occurrence of a few species. Recently I became aware of the fact that no one had yet established the identity of the rosy finch that breeds on the mountain. Merriam was unable to do so because of lack of specimens. This led me to visit some of the alpine areas on the peak in the course of the past summer.

The only species of birds which Merriam lists (*op. cit.*, p. 68) as restricted to the Alpine Zone on Mount Shasta are the Pipit (*Anthus spinoletta*) and the Rosy Finch (*Leucosticte tephrocotis*). The sole basis for considering the Pipit to be a summer resident, and hence an alpine indicator, is given in the following annotation (p. 130): "In a barren rocky basin above timberline, near the head of Panther Creek, on July 17 I heard titlarks and saw Arctic bluebirds."

From July 13 to 18, 1939, I camped on Panther Creek, and on the 14th, 15th, and 17th carefully searched the basins and slopes from timberline (8000 feet) to about 10,000 feet at the headwaters of the creek. No pipits could be found, and although the country would be suitable for transients of this species, it was so lacking in alpine turf and in surface moisture that it seemed to me most unlikely as a breeding area. The region does not afford habitat like that in which pipits breed in the Cascade Mountains of Washington and in the Wallowa Mountains of eastern Oregon. East of Panther Creek at the head of Squaw Creek, a tract of streamside turf extends upward between arid pumice and lava slopes to about 9000 feet. Of all areas on the south and southeast sides of the peak, this most nearly resembles adequate breeding habitat; but no pipits could be found here on July 17. Negative evidence is not conclusive, yet I feel that the information now at hand does not warrant the assumption that pipits nest as far south as Shasta. We need not doubt that Merriam heard pipits in summer on the mountain. They may well have been strays that were not breeding.

In hunting for rosy finches, I was guided by the statement (p. 124) that, "At an altitude of 10,000 to 11,000 feet . . ., Vernon Bailey saw half a dozen leucosticte August 17, and again the next day . . . . feeding among the rocks and on the glacier which occupies the deep cross gulch just below Konwokitan glacier." In this gulch, and on the east rim of it, at the head of Mud Creek, I found rosy finches on July 15, 1939. Three were noted, and two collected, at 10,000 feet. One of the birds, a female (Mus. Vert. Zool. 76205) was carrying a large supply of insects in her mouth, and she had a brood patch. Evidently leucosticte were nesting sparingly and scatteringly in the crumbling cliffs about the glaciers. The gulch was exceedingly barren of life. Rock Wrens (*Salpinctes obsoletus*) were the only other birds seen at 10,000 feet. Clark Nutcrackers (*Nucifraga columbiana*) and Mountain Bluebirds (*Sialia currucoides*), sub-alpine types, stayed lower, not venturing far above the highest thickets of timberline scrub at 9000 feet. A Townsend Warbler (*Dendroica townsendi*) was found dead in the snow at 11,000 feet, evidently a bird lost in the preceding spring migration.

The leucosticte proved to be *L. t. littoralis*, the Hepburn Rosy Finch. Thus the breeding range of this distinctive form is extended southward into California from the Three Sisters region of central Oregon. Rosy finches breed at Crater Lake, Oregon, 100 miles north of Shasta, but to my knowledge none has been collected there for racial determination. There is little doubt now that they also would be *littoralis*. Between Mount Shasta and the northern end of the breeding range of the Sierra Nevada Rosy Finch (*L. t. dawsoni*) is a gap of somewhat over 150 miles.

The Shasta specimens show gray checks and a broad gray nuchal area that are typical of summer specimens of *littoralis*. On some of the auricular feathers there are cinnamon brown areas, but such may be seen occasionally in worn July-taken skins of *littoralis* from coastal British Columbia. Although there is no decisive evidence of intermediacy between *littoralis* and *dawsoni* in the color pattern of the head, the color of the body is somewhat intermediate. The back is dark as in *littoralis*, but the cinnamon brown under parts are of a lighter tone than in *littoralis*. This tone is as light as in *dawsoni*, but the color is not so gray or neutral as in that form. *Littoralis* and *dawsoni* do not differ significantly in dimensions. The two birds from Shasta are small, near the minimum for most measurements of *littoralis* and *dawsoni*.

The sparse population of rosy finches on Mount Shasta, when it is further sampled, may yet prove to be consistently different from neighboring races to the north and south. From data we now have, however, we can but view the slight departure from *littoralis* as intergradation toward *dawsoni*. This conclusion should not obscure the fact that the fundamental relationship of the Shasta birds is with *littoralis*.—Alden H. Miller, *Museum of Vertebrate Zoology, Berkeley, California, September 5, 1939.*

The Glaucous Gull at Santa Barbara, California.—On April 4, 1939, I noticed among a flock of Western, Glaucous-winged, and Ring-billed gulls, a large, very whitish gull. This was at the Santa Barbara city dump where there is always a great number of gulls of various species feeding on the refuse. I saw immediately that this bird was much larger and lighter in color than the Glaucous-winged Gulls which were standing near it.

The bird was collected and is now no. 3613 in the collection of the Santa Barbara Museum of Natural History. It proved to be a female Glaucous Gull (*Larus hyperboreus*) in the light plumage of the second year.

This species of gull has been reported in this region several times, but as far as I can learn this is the first specimen that has been collected here.—Egmont Z. Rett, *Santa Barbara Museum of Natural History, Santa Barbara, California, April 27, 1939.*

Shrikes, Red-wings, and the Cowbird.—The White-rumped Shrike (*Lanius ludovicianus excubitorides*) is one of the few smaller passerines that is not known to be parasitized by the Cowbird (*Molothrus ater*). On June 8, 1938, at Eastend, Saskatchewan, the writer found a shrike's nest with six eggs, and later, the nest of a Brewer Blackbird (*Euphagus cyanocephalus*) containing five eggs and one of a cowbird. The cowbird egg I took and placed in the shrike's nest, removing one of the six to make the number as before.

On June 15 the cowbird's egg was found to be hatched. On June 18 the young cowbird was still in the nest and apparently well cared for; the shrike's eggs still were unhatched. On June 22 the cowbird was in the nest, but on my close approach it took flight to a willow bush some sixty yards away. All five shrike eggs were now hatched, but the nestlings were scarcely able to hold up their heads and were evidently *in extremis*. On the following day the nestling shrikes had disappeared. The parent birds were close by, looking somewhat disconsolate, but they still appeared to be feeding the cowbird, which was very wild.

It would seem, then, that if a cowbird could steal unobserved into a shrike's nest and lay her egg, it would be accepted; but the vigilance and aggressive nature of the shrikes would prevent this happening.

During the summer of 1931 a few pairs of Red-winged Blackbirds (*Agelaius phoeniceus*) nested in the brush alongside the river. Two of the male red-wings were most intrepid in defense of their nests. Whenever the writer or any other person approached the spot, the red-wings would attack from above; and only by constantly brandishing a stick could they be kept from vicious pecking of one's head. Nevertheless, in one red-wing nest a cowbird was reared; in the other nest two cowbirds. How was it that the vigilance and extremely aggressive nature of the Red-winged Blackbirds did not suffice to keep the cowbirds out as the White-rumped Shrikes appear to do?—LAURENCE B. POTTER, *Gower Ranch, Eastend, Saskatchewan, Canada, May 1, 1939.*

House Finch Nesting in British Columbia.—In June, 1939, a pair of House Finches (*Carpodacus mexicanus* subsp.) built their nest in a Virginia creeper (*Ampelopsis cinquefolia*) which climbs up the veranda of my house at Okanagan Landing. The nest, sheltered from view by thick foliage, was fastened securely between one of the veranda posts and a branch of the vine. When first examined, it contained five eggs. Both birds were shy and quiet, contrary to their usual habit elsewhere. The female would leave the nest at the least disturbance in the vicinity; the male was seen in her company and also on his singing perches, one of which was a nearby telephone wire, another a fence wire. The eggs hatched on June 18; the young left the nest a week later and up until the date of writing neither the adults nor the young have again been seen in the vicinity.

Two earlier observations of the nesting of this species in British Columbia (Penticton in the Okanagan Valley, and Victoria on Vancouver Island) are recorded by Cowan (Condor, vol. 39, 1937, p. 225). Okanagan Landing, which is about seventy miles north of Penticton, would appear to be the third locality from which the species has been recorded in Canada.—J. A. MUNRO, *Okanagan Landing, B. C., July 8, 1939.*

An Occurrence of the Arctic Horned Owl in Western Colorado.—On the afternoon of May 10, 1939, while walking up the south fork of Quartz Creek above the town of Pitkin, Gunnison County, Colorado, at an elevation of approximately 9400 feet, I came upon a group of feathers. The snow had just gone off the ground and it was apparent that the feathers had been on the snow, as the ground nearby was devoid of any marks or tracks. Further inspection revealed that no one else had been in the gulch since the snow had melted. The surrounding timber is a mixture of Engelmann spruce, lodgepole pine and aspen growing close to a beaver-inhabited stream. Some of the feathers were sent to Dr. Joseph Grinnell who kindly identified them for me as those of the Arctic Horned Owl (*Bubo virginianus subarcticus*). It is apparent that this winter visitant met its death between October 28, 1938, when I passed the same spot, and May 10, 1939. There are comparatively few records of the Arctic Horned Owl in Colorado.—ARTHUR F. HALLORAN, *Pitkin, Colorado, May 26, 1939.*

New Bird Records for Clark County, Nevada.—Observations made during the past year in the Boulder Dam Recreational Area have resulted in a number of bird records. Most of these observations were made in the vicinity of Hemenway and Las Vegas washes near Boulder Dam, in the Virgin Basin east of Boulder Canyon, and at St. Thomas and Kaolin Reservoir on the north arm of Lake Mead. The following is a list of species heretofore unrecorded from Clark County, Nevada.

Eared Grebe. *Colymbus nigricollis californicus.* Uncommon resident. Recorded in April, May, June, August and December, 1938, in Hemenway wash and at St. Thomas. Young were observed on June 14, 1938.

Western Grebe. *Aechmophorus occidentalis.* Resident. Records for May, July, September and December, 1938, at St. Thomas and along the Colorado River below Boulder Dam.

Pied-billed Grebe. *Podilymbus podiceps podiceps.* Resident. Records taken throughout 1938-1939 at St. Thomas and Hemenway wash.

Brewster Egret. *Egretta thula brewsteri.* Transient visitant. Records for May, August and September, 1938, at St. Thomas and Hemenway wash.

American Bittern. *Botaurus lentiginosus.* Transient visitant. Observed at St. Thomas in April and May, 1938.

Western Least Bittern. *Ixobrychus exilis hesperis.* Transient visitant. Records for August and September, 1938, at Hemenway wash and St. Thomas. First records for southern Nevada.

White-faced Glossy Ibis. *Plegadis guarauna.* Transient visitant. Observed at St. Thomas in April, May and September, 1938.

Black Brant. *Branta nigricans*. Transient visitant. Observed in the Virgin Basin in March and August, 1938. First records for southern Nevada.

Gadwall. *Chaulelasmus streperus*. Transient visitant. Recorded at St. Thomas in August, September and November, 1938.

Lesser Scaup Duck. *Nyroca affinis*. Transient visitant. Observed at St. Thomas in October, November and December, 1938.

Swainson Hawk. *Buteo swainsoni*. Transient visitant. Recorded at St. Thomas on April 13, 1938.

Western Snowy Plover. *Charadrius nivosus nivosus*. Transient visitant. Observed along the lake near St. Thomas on June 20, 1938; collected from the same area on April 10, 1939. First records for southern Nevada.

Semipalmated Plover. *Charadrius semipalmatus*. Transient visitant. Two were observed along the lake at St. Thomas on May 7, 1938. First records for southern Nevada.

Long-billed Curlew. *Numenius americanus*. Transient visitant. Eleven were observed along the lake at St. Thomas on May 7, 1938.

Greater Yellow-legs. *Totanus melanoleucus*. Transient visitant. Recorded at St. Thomas in May, September and November, 1938.

Least Sandpiper. *Pisobia minutilla*. Transient visitant. Records from April and May, and August to December, 1938, at Hemenway wash and St. Thomas.

Marbled Godwit. *Limosa fedoa*. Transient visitant. Observed at St. Thomas in June and October, 1938. First records for southern Nevada.

Northern Phalarope. *Lobipes lobatus*. Transient visitant. Six were observed along the lake at St. Thomas on October 20, 1938; several were observed in the same locality throughout May, 1939.

California Cuckoo. *Coccyzus americanus occidentalis*. Summer visitant. Two were observed at Kaolin Reservoir on June 27, 1938. First record for southern Nevada.

Eastern Kingbird. *Tyrannus tyrannus*. Transient visitant. One was observed at St. Thomas on April 13, 1938. First record for southern Nevada.

Cassin Kingbird. *Tyrannus vociferans*. Transient visitant. Two were observed at St. Thomas on June 20, 1938. They were driven away from a group of *T. verticalis* by a number of quarrelsome males. First record for southern Nevada.

San Pedro Bluebird. *Sialia mexicana anabelae*. Transient visitant. Recorded and collected in November and December, 1938, in Las Vegas wash. First records for Nevada.

Bohemian Waxwing. *Bombycilla garrula pallidiceps*. Transient visitant. One collected on April 30, 1938, at Willow Beach where it had flown from the Nevada shore on the opposite side of the Colorado River. First record for southern Nevada.

California Yellow Warbler. *Dendroica aestiva brewsteri*. Transient visitant. One was collected in Hemenway wash on September 19, 1938.

Hermit Warbler. *Dendroica occidentalis*. Transient visitant. One was collected in Hemenway wash on September 13, 1938. First record for southern Nevada.

Fox Sparrow. *Passerella iliaca* ssp. Transient visitant. Observed below Boulder Dam on August 29, 1938.—Russell K. Grater, *National Park Service, Boulder City, Nevada, June 3, 1939.*

NOTES AND NEWS

The Fifty-seventh Annual Meeting of the American Ornithologists' Union was held at the Museum of Vertebrate Zoology, University of California, Berkeley, and at the California Academy of Sciences, San Francisco, California, June 19-24, 1939, with a registered attendance of 248. A total of 30 scientific papers was read, many illustrated by colored slides or films. The three days of program sessions included a like number of evening entertainments, Open House at the Museum, the Annual Dinner, and business meetings of various sections. On Friday 108 ornithologists in attendance visited Point Reyes to study nesting colonies of aquatic birds on rocky islands along the Pacific Coast. On Saturday and Sunday, 42 visitors traveled to Point Lobos, Monterey County, and to the Hastings Research Area.

Officers elected for the new year were as follows: President, James P. Chapin, New York City; Vice-presidents, J. L. Peters, Cambridge, Massachusetts, and George Willett, Los Angeles; Secretary, Lawrence E. Hicks, Columbus, Ohio; Treasurer, Rudyerd Boulton, Chicago, Illinois; Council: P. A. Taverner, Ottawa, Canada, Ludlow Griscom, Cambridge, Massachusetts, and Alden H. Miller, Berkeley, California.

The Brewster Medal was awarded posthumously to Dr. Witmer Stone for his two volumes on "The Birds of Old Cape May." Two Fellows, George Willett, Los Angeles, California, and Alden H. Miller, Berkeley, California, one Honorary Fellow, Oskar Heinroth, Berlin, Germany, and two Corresponding Fellows, G. C. A. Junge, Leyden, Netherlands, and David Lack, London, England, were elected.

In addition to 532 new Associate Members, 7 new Members were named: Paul Kellogg, Ithaca, New York; Wesley F. Kubichek, Washington, D. C.; Joseph A. Hagar, Marshfield Hills, Massachusetts; Emmet R. Blake, Chicago, Illinois; Ivan R. Tomkins, Savannah, Georgia; Louis W. Campbell, Toledo, Ohio; Owen J. Gromme, Milwaukee, Wisconsin.

The 1940 meeting will be held in Boston in October, and the 1941 meeting in Denver. In 1942 there will be a joint meeting in May at Philadelphia with the Tenth International Ornithological Congress.—LAWRENCE E. HICKS, *Secretary, American Ornithologists' Union.*

MINUTES OF COOPER CLUB MEETINGS

NORTHERN DIVISION

MAY.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday, May 25, 1939, at 8:00 p.m., in Room 2503 Life Sciences Building, Berkeley, with President Emlen in the chair and 75 members and guests present. Minutes of the Northern Division for April were read and approved. Names proposed for membership were: Torrey Lyons, Wake Island, care Pan-American Airways, Treasure Island, San Francisco, California, by J. Grinnell and E. R. Hall; Mrs. Frieda Abernathy, 2226 McGee Avenue, Berkeley, by Margaret W. Wythe.

Mr. Moffitt announced the schedule for the annual meeting of the American Ornithologists' Union, to be held in Berkeley and San Francisco, June 19-24. Because of this meeting, there will be no June meeting of the Cooper Club. Meetings of the American Association for the Advancement of Science and the Sixth Pacific Science Congress will also be held in the Bay region this summer. Mrs. Kelly reviewed Gayle Pickwell's recent book, "Birds," and spoke of its wealth of information and illustrations.

Field observations included reports of Cassin Kingbirds nesting in Arroyo Mocho, by Mrs. Saunders, and a Road-runner in Strawberry Canyon, by Mr. Taylor. Other members reported Cliff Swallows nesting in the Edwards Field grandstand in Berkeley, and Hudsonian Curlews eating crickets in a cut-over hay field.

The speaker of the evening was Mr. David Lack, co-leader of an expedition to the Galapagos Islands, under the auspices of the London Zoological Society and the Royal Society of London. The expedition's habit-studies of the unique group of ground-finches endemic to the Galapagos were the basis of Mr. Lack's talk. He discussed the curious speciation of these finch-like geospizids, showing that it could not be explained by differences in habitats, or by differences in breeding or feeding habits. The size and shape of bill vary strikingly between species, but the form of the bill seemed to be adaptive in only one species, the flower-probing *Geospiza scandens*. Actually, variations in bills seem to be even more important than differences in body size or color for recognition between species. Apparently the bills have been of primary importance in the speciation of the geospizids, differences in bills being retained because of their effectiveness in keeping groups apart.

Mr. Lack enriched his talk with much interesting information on the Galapagos Islands and their fauna. The tale of *Cactospiza* using a tool to push out burrowing insects was fully confirmed by the expedition's studies. The meeting concluded with discussion stimulated by Mr. Lack's excellent presentation.

Adjourned.—FRANK RICHARDSON, *Acting Secretary.*

JULY.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday, July 27, 1939, at 8:00 p.m., in Room 2503 Life Sciences Building, Berkeley, with Mr. Frederick H. Test presiding and more than 100 members and guests present. Minutes of the Northern Division were read, approved and later corrected. Names proposed for membership were: J. R. Alcorn, R. R. 1, Box 19a, Fallon, Nevada, by E. R. Hall; Mrs. Enid K. Austin, 541 Boulevard Way, Piedmont, California, by Junea W. Kelly; Dale K. Barnes, 1102 Neilson Street, Albany, California, and Carl Frederick Haynke, 813 San Carlos Avenue, Albany, California, both by Alden H. Miller; R. Frank Hedges, Box 1348, Soil Conservation Service, Albuquerque, New Mexico, by Lawrence V. Compton.

The following resolutions were read and unanimously adopted:

"WHEREAS, on May 29, 1939, the death of Joseph Grinnell deprived the Cooper Ornithological Club of its most revered and distinguished member, who was President of the Board of Governors and Editor of the CONDOR, and

"WHEREAS, since the first of the century Joseph Grinnell unstintingly served the Club and for a generation guided the study of vertebrate animals in western North America, and

"WHEREAS, his friendship and enthusiasm was enjoyed and deeply appreciated by a remarkably large number of members who had benefited in the pursuit of their studies and avocations by his direct assistance, through his wise teachings, or by the example of his painstaking work,

"BE IT THEREFORE RESOLVED, that the Cooper Ornithological Club express its profound regret in the untimely loss of this most valued member who was in truth the leader of the Club and a man of remarkable endowments, and

"BE IT FURTHER RESOLVED, that these resolutions be sent to the family with the expression of the deepest sympathy of the Club."

Dr. Painton announced the election of the following new officers at the June meeting of the Stanford Chapter: President, Mr. John Applegarth; Secretary, Miss Marion Theobald.

Mr. David G. Nichols reported some observations upon Steller Jays, made from a blind at 900 feet elevation in the Berkeley hills. Mr. Milton Ray gave nesting records from high altitudes in the Sierra Nevada, commenting upon the remarkable lack of snow, which made many passes accessible by early May instead of late June. Mr. Ray also displayed two photographs, taken in London, of a mounted specimen of the Great Auk, which was recently acquired by the American Museum. Mrs. Kirsten Hofgaard showed a small collar made from cormorant skin and used by Greenland Eskimos as a removable lining for fur garments in winter.

Professor Arthur A. Allen, the speaker of the evening, presented, "Some Experiences in Natural Color Photography of Birds." He spoke of the Cornell University project of recording bird songs on film. The first pictures accompanying these records were in black and white. The trip to California in May of this year gave opportunity for making 16 mm. colored motion pictures of such birds as herons in Louisiana, Roseate Spoonbills in Texas and Coppery-tailed Trogons in Arizona. The sound track had been placed on one of these reels, and a "preview" of this pioneer work was enjoyed by the audience. Among the advantages of color film in bird photography were mentioned the effect of perspective, color of nest materials and the iridescence of feathers, all of which are difficult to obtain in hand coloring of film. A semi-slow-motion may be used with good effect. Dr. Allen answered various technical questions asked by members.

Adjourned.—FRANCES CARTER, *Recording Secretary.*

SOUTHERN DIVISION

APRIL.—The regular monthly meeting of the Southern Division of the Cooper Ornithological Club was held at the Los Angeles Museum on Tuesday, April 25, 1939, at 8 p.m., with Mr. Sidney Peyton in the chair and sixty-three members and guests present.

The minutes of the Southern Division for March were read and approved. One application for membership was read: Ida S. DeMay, 3119 Hope St., Huntington Park, California, proposed by Loye Miller.

There being no further business, Mr. Peyton called upon Dr. Loye Miller to proceed with the program of the evening. Dr. Miller's talk, "Some Off-shore Birds of Southern California," dealt with his several trips with members of the Scripps Institute of Oceanography on their survey of the waters from San Luis Obispo south to San Diego; the trips extend off-shore 150 to 200 miles. The surveys have been taken quarterly for a period of two years, over a definite course charted on four transecting lines, with thirty-three stations along these lines where stops are made for investigation. Dr. Miller was present on four of these trips, in the course of which he has made interesting and valuable observations on the bird life. In his usual entertaining manner he presented the results of these observations, particularly as they pertained to conditions out beyond the islands.

Following the talk, Dr. Miller answered several questions from members.

Adjourned.—HILDEGARDE HOWARD, *Secretary.*

MAY.—The May meeting of the Southern Division of the Cooper Ornithological Club was an outing meeting held in Castaic Canyon on Sunday, May 28, 1939. About fifty members and guests followed the signs which the Peytons had posted along the ten miles of canyon road leading to the meeting place at Cienaga Public Camp. Picnic lunches were embellished by coffee and ice cold orange juice furnished by the Peytons. Being the occasion of Mr. Willett's birthday, he was presented with a birthday cake from the Southern Division.

A short business meeting was called to order at 1:30 p.m. by President Peyton. The minutes of the April meeting of the Southern Division were read and approved. Seven applications for membership were read, as follows: Mrs. Maybelle Stalleup, Montagne, California, proposed by John McB. Robertson; Carl B. Koford, 1517 Euclid Ave., Berkeley, California, by J. R. Pemberton; Sam D. Hinton, 421 Wing St., Glendale, California, by Loye Miller; and Roger T. Peterson, 1006 Fifth Ave., New York, N.Y., Will A. Friend, Los Altos, California, and Donald Culcross Peattie, 224 Buena Vista Road, Santa Barbara, California, all proposed by W. Lee Chambers.

Mr. Clinton G. Abbott called attention to a bill (A. B. no. 1365) which has passed the California State Assembly legalizing the killing of sea lions in California waters. He indicated the importance of contacting our state senators and making known our opposition to the bill in order to prevent its passage in the senate.

The deaths of A. W. Anthony and Witmer Stone were announced.

Adjourned.—HILDEGARDE HOWARD, *Secretary*.

JUNE.—The regular monthly meeting of the Southern Division of the Cooper Ornithological Club was held at the Los Angeles Museum on Tuesday evening, June 27, 1939, with President Peyton in the chair and about forty members and guests present. The regular secretary being absent, the secretarial duties were performed by George Willett.

The minutes of the May meeting of the Southern Division were read and approved. The following applications for membership in the club were read: Albert F(ranklin) Ganier, 2112 Woodlawn Drive, Nashville, Tennessee, proposed by John McB. Robertson; William Longhurst, Box 5500, Sonoma Highway, Napa, California, Rudyerd Boulton, Field Museum, Chicago, Illinois, both by W. Lee Chambers.

Eastern visitors introduced by the President were Dr. James P. Chapin, of the American Museum of Natural History, President of the American Ornithologists' Union, who called attention to the plans for a meeting of the International Ornithological Congress to be held in Philadelphia in 1942; Mr. Rudyerd Boulton, of the Field Museum, who spoke of the similarity of southern California to some parts of Africa; and Mr. George H. Lowery, Jr., of Louisiana State University, who told of a trip made that day to the haunts of the California Condor in Ventura County, and expressed his satisfaction in being one of the few ornithologists who had seen both this bird and the Ivory-billed Woodpecker on their breeding grounds.

Dr. Loye Miller gave an account of the recent American Ornithologists' Union meeting in the San Francisco Bay region, mentioning particularly the excellent pictures shown of California Condor, White-tailed Kite and Coppery-tailed Trogon. W. Lee Chambers announced that the proposed bill to open season on the sea lion in California waters had been defeated in the State Senate. Dr. Miller expressed belief that the defeat of this bill would probably be beneficial to the sea otters and sea elephants along our coast. John McB. Robertson reported the appearance of a Cactus Wren at Buena Park, Orange County, where the species had not been seen for many years. A single bird built a nest in a cactus plant in a garden and used it for a roosting place. Robert Hannum spoke of a light-colored phase of the English Sparrow apparently developing at Palms, Los Angeles County; about twenty-five per cent of the sparrows in the vicinity of his residence are of this light phase. A. O. Reis gave an account of the nesting of some species of birds in the Sierra Nevada this year. Nests of Cassin Purple Finches and Hermit Warblers were found situated under loose bark on lodgepole pines. A number of nests of the Gray Flycatcher that were found contained only two eggs each.

Mr. Gilbert spoke of two recent visits to the Malheur Lake Bird Reservation and told of the gradual increase of nesting birds in that locality. S. B. Peyton told of Condors, hummingbirds, Black Swifts and Purple Martins seen in the Ventura Mountains; also of an apparent increase in numbers of White-tailed Kites in Ventura County where they are frequently seen hunting over alfalfa fields. Mr. Crawford reported a colony of Least Terns on mud flats of Alamitos Bay; many nests contained only one egg or young. He also recorded Marbled Godwits on June 25. C. V. Duff reported three nests of Florida Gallinule, containing six eggs each, found recently in Kern County. Mr. Hannum spoke of the habits of Elf Owls in captivity. They are apparently entirely insectivorous, refusing to eat mice that are offered them.

Adjourned.—GEORGE WILLETT, *Acting Secretary*.

For Sale, Exchange and Want Column.—Each Cooper Club member is entitled to one advertising notice in any issue of The Condor free. Notices of over ten lines will be charged for at the rate of 15 cents per line. For this department, address JOHN McB. ROBERTSON, Buena Park, California.

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